DETAILED REPORTS OF SUBORDINATE OFFICERS OF THE DEPARTMENT OF AGRICULTURE MADRAS

FOR

1950–51

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DETAILED ANNUAL REPORT OF THE GOVERNMENT AGRICULTURAL CHEMIST FOR THE YEAR 1950-51.

I submit herewith my annual report for the year 1950-51.

Charge.—Sri P. D. Karunakar was in charge of the post of the Government Agricultural Chemist for the major portion of the year, till 2nd May 1951. I took over charge from him in the forenoon on 2nd May 1951 and have continued to hold it since then.

Staff.—Sri P. D. Karunakar, the permanent Government Agricultural Chemist, was on leave from 1st to 26th July 1950 and I was in full additional charge of the post during the period. Sri P. D. Karunakar resumed charge of his post from the forenoon of 27th July 1950 and continued to do so till 2nd May 1951.

Sri P. Kunhirama Menon, Assistant, was promoted as Assistant Agricultural Chemist, Bhairavanitippa project, from the forenoon of 10th August 1950 and continued as such till 18th September 1950 when the traverse and soil survey were completed.

Sri T. Rajagopala Ayyangar returned from leave on 18th September 1950 and was reposted as Gazetted Assistant in Chemistry relieving Sri D. V. Krishna Rao who was transferred as Soil Survey Officer, Bellary. Sri T. Rajagopala Ayyangar was posted as Soil Survey Officer, Bellary, and Sri D. V. Krishna Rao as Gazetted Assistant in Chemistry with effect from 27th October 1950. Sri T. Rajagopala Ayyangar continued as Soil Survey Officer, Bellary, till 11th June 1951 when he was appointed as Agricultural Bacteriologist, Coimbatore, consequent on the closure of the soil survey work.

Sri D. V. Krishna Rao, Gazetted Assistant, handed over charge of his post to Sri C. Raghavendrachar and proceeded on deputation to England and Palestine with effect from 28th February 1951.

Sri E. J. Verghese, Assistant, was promoted as Gazetted Assistant in Chemistry from 2nd June 1951.

Subordinate Staff.—Sri A. Balasubramaniam and Sri G. Jaganatha Rao were transferred from my section on the closure of the scheme on "The Chemical Investigation of Cholam Effect" at Koilpatti and were relieved on 25th July 1950.

The following assistants reported for duty on the dates noted against their names :—

1	Kumari M. Indira Moosad	.. 30th October 1950.
2	Sri M. Madhava Prabhu ..	.. 30th October 1950.
3	„ C. Dharma Rao ..	.. 18th December 1950.

4	„ R. Thyagarajan ..	.. 15th December 1950.
5	„ N. M. Thyagarajan ..	.. 15th December 1950.
6	Sri A. N. Ramaswamy ..	.. 18th December 1950.
7	„ K. Sivarama Shetty ..	.. 19th December 1950.
8	„ M. Damodaran Nambiar	.. 3rd January 1951.
9	„ S. Lakshmanan ..	.. 16th January 1951.
10	„ T. Seshagiri Rao ..	.. 18th February 1951.
11	„ N. C. Gopalachari ..	.. 31st May 1951.
12	„ R. Kaliappan ..	.. 29th June 1951.
13	Kumari Vinodini Vasudevan	.. 2nd June 1951.
14	„ K. Samathuvam ..	.. 1st June 1951.

Sri K. S. Varadan, K. Rama Rao and M. Madhava Prabhu, temporary assistants, tendered the resignations of their posts to take up other appointments.

Tours —Myself, my gazetted and non-gazetted assistants toured several tracts and localities in the State in the course of our work.

Training.—Sri C. R. Venkataraman, T. A Govinda Ayyar and M. P. Sankaranarayanan, Assistants, have completed their training in Soil Survey in the Indian Agricultural Research Institute, New Delhi. Sri T. R. Srinivasan, Assistant in Chemistry, deputed for post graduate course in Chemistry at the Indian Agricultural Research Institute, New Delhi, has yet to complete the course. Sri D. V. Krishna Rao, Assistant Agricultural Chemist, is on deputation to United Kingdom and Palestine

A batch of junior Gazetted Officers and senior assistants of my section were given a course of training in theoretical and practical microbiology by me.

Accommodation :– As per orders of the Director of Agriculture, Madras, issued during his inspection in June 1951 the well established laboratory of the Agricultural Bacteriologist of over 20 years standing was shifted from the north-east corner of the Agricultural Research Institute to a smaller room where the Government Agricultural Chemist used to sit and arrange the exhibits of the section. As a consequence of this the present Agricultural Bacteriologist's laboratory is cramped for space. There is no washing-sink in the laboratory and there are not sufficient gas connections. Table for plating work and cupboards for keeping chemicals and samples are also required.

The work of the section may be reported under three heads— (1) Teaching, (2) Analytical and Advisory; and (3) Research.

Teaching.

Sri M. Sundaram and Sri D. V. Krishna Rao, assisted by three assistants were primarily in charge of teaching work. For a period of 2½ months Sri T. Rajagopala Ayyangar was also in the Teaching section. As in previous year members of the Chemistry Section with experience in the particular branches of Agricultural Chemistry were deputed to take lecture classes. Thus Geology was dealt

with by Sri C. Raghavendrachar, Soils by Sri F. L. Daniel and Sri John Durairaj, Inorganic Manures by Sri T. S. Lakshmanan, Organic Manures by Sri P. D. Karunakar and Dairy Chemistry by me. Sri E. J. Verghese and Sri P. Kunhirama Menon dealt with organic chemistry for B.Sc. Ag., Class I.

The number of lectures delivered and the practical classes held during the year are given below:—

	Number of classes.	*Number of hours.*
First Year B.Sc. (Ag.) Class—		
Theory	56	56
Practical—A & B Batches	53	
Practical—C & D Batches	53	
Second Year B.Sc. (Ag.). Class—		
Theory	56	56
Practical—A & B Batches	29	58
Practical—C & D Batches	29	58
Third Year B.Sc. (Ag.) Class—		
Theory	153	153
Practical—A & B Batches	85	170
Practical—C & D Batches	84	168

Research Students.—The following two upper subordinates registered for the M.Sc. Degree of the Madras University are working under my guidance and supervision :—

Name.	*Designation.*	*Subject for M.Sc thesis.*
1. Sri R. Soundararajan,	Assistant in Chemistry	Studies on the Keeping Quality of Ghee.
2. V. T. R. Rajagopalan,	Dairy Manager, Agricultural College and Research Institute.	Preservation studies in Milk.

The following assistants of my section who had registered for the M.Sc. degree in the previous years are in various stages of work :—

Name.	*Subject for the M.Sc. Degree*
1 Sri S. Varadarajan	Studies in Fungal diastase with special reference to Aspergillu oryzae.
2 Sri C. R. Venkataraman ..	Studies on the intake of phosphorus in one dose and in split doses at various periods during the growth of the crop ;
3 Sri D. John Durairaj ..	A study of the soil types of South India in relation to their colour, and physical and chemical properties.
4 Sri S. Gopalakrishnan ..	Translocation of copper in Plants.

These assistants were working under the guidance and supervision of Sri P. D. Karunakar, the former Government Agricultural Chemist. They are now working under my supervision and guidance. Necessary arrangements are being made for the change of professorship of these candidates.

Special lectures.—Sri J. H. S. Ponniah, Probationary District Agricultural Officer, under training was given lectures by various members of my section between 8th and 16th May 1951 on the activities and achievements of the section.

The following special lectures were delivered to the Horticultural trainees of the Fruit Specialist's section by the officers of my section :—

(1) "Site Selection for fruit development in the Ceded Districts" by Sri M. Sundaram, Assistant Agricultural Chemist.

(2) " Manurial requirements of Orchard trees " by Sri T. S. Lakshmanan, Assistant Agricultural Chemist.

(3) " Laterite Soils—How they are formed and their productivity so far fruit cultivation is concerned " by Sri C. Raghavendrachar, Assistant Agricultural Chemist.

Analytical and Advisory.

The analytical and advisory work constitutes one of the largest and important phases of the activities of the section. Sri T. S. Lakshmanan continued to be in charge of the section throughout the year.

The activities of this branch of the section consisted mainly in the analysis of soils, manures, fodders, foodstuffs, irrigation waters, sugarcane, other agricultural materials and products and miscellaneous samples. The services of this section were fully utilized by ryots and the general public, by manure firms, industrial concerns and officers of the Agricultural and other departments including Civil Supplies, Electricity, Irrigation, Cinchona and Public Works Departments. It continued to do its useful work in answering the numerous queries received on matters pertaining to the improvement of soil fertility, manuring, feeding of livestock, irrigation waters, reclamation of saline and alkaline soils, etc., which are all connected with the Grow More Food Campaign.

One thousand eight hundred and eighty-seven samples of various kinds were received and registered during the year. Of these 1,706 samples were analysed and reported including some arrears of samples. The samples may be classified as below according to their nature, source of receipt, etc. :—

Nature of sample.	*Agricultural Departments.*	*Other Government Departments.*	*Private.*	*Total.*
Soils	812	6	30	848
Manures	62	24	222	308
Foodstuff	8	25	..	33
Plant products	266	26	2	294
Waters	141	..	13	154
Miscellaneous	47	21	1	69
Total ..	1,336	102	268	1,706

The receipts by way of analysis fees amounted to Rs. 3,649 as against Rs. 2,862 in the previous year.

Among the various items of work carried out by the section for Government departments and the public the following may be mentioned as of special interest :—

(1) Soil samples from Peddapuram, Salem, Madurai, Mangalore, Tirurkuppam and Puthur areas were analysed for chemical and mechanical composition and water soluble salts. The water samples from these areas were analysed to find out their suitability for irrigation.

(2) Four samples of soil from the Cardamom area of Singampatti were analysed for chemical constituents to ascertain which of them are responsible for the poor growth of the species.

(3) Sixty samples of paddy grain and straw were examined for fundamental research studies.

(4) Twelve paddy strains were analysed for nutritive value.

(5) Three samples of buck wheat-grain and plant were analysed for food value.

(6) Two samples of water sent by the Agricultural Demonstrator, Erode, were examined to find out whether they contain injurious salts as a consquence of admixture with tannery effluent and whether they can be used for irrigation.

(7) Soil samples from arecanut gardens received from the Plant Protection Officer (Mycology) were analysed for their pH values ;

(8) Fodder grasses, thin Napier, Napier and guinea grass were subjected to analysis to estimate their food value ;

(9) One hundred twelve samples of soil and eight samples of water from the Bhairavanitippa project area in the Ceded districts were examined to ascertain their suitability for irrigation.

(10) One sample of lignite received from the Mining Officer, South Arcot, was studied for its manurial value.

(11) Three water samples from Dalmiapuram, Tiruchirappalli district, were examined for their suitability for irrigation.

(12) The starch content was estimated in twelve samples of tapioca.

(13) The compost samples prepared and sent by municipalities were analysed for their manurial value.

(14) The water and soil samples taken from the lands of Sri A. K. Venkitaraja, Rajapalayam, were analysed. The soil samples were particularly examined for their alkalinity.

(15) Four samples of coconut husk sent from the Kasargode farm were examined to study the extent of decomposition which takes place when they are buried in the soil.

(16) Twenty-eight samples of soil from the Rice Research Station, Tirurkuppam, were analysed to ascertain whether the method evolved by Sri S. Ganesan is effective in removing the alkalinity of soils.

(17) Deccan Grasshoppers feeding on young cholam plant containing cyanogentic glucosides may show hydrocyanic acid in their excreta. This was tested and the excreta was found to contain no hydrocyanic acid.

(18) Six samples of ammonium sulphate received from the District Agricultural Officer, Tiruchirappalli, were tested for adulteration with sand and other materials.

(19) One sample of grain and one of straw of Ergostis were analysed for food value.

(20) The starch content and sugars were estimated in four varieties of sweet potato.

(21) Three samples of water from the tannery at Erode were analysed for the salts present in them and to ascertain whether they are suitable for irrigation. A sample of sediment from the same tannery was also analysed for the salts present in it.

(22) One sample of milk powder received from the Mysore Fertilizer Company, Madras, was analysed for its manurial value.

(23) The Agricultural Demonstrator, Gudur, sent 8 samples of Pattimannu and soils suspected to be alkaline. The pH values of the soils do not show them to be alkaline and they contain higher amounts of nitrogen, phosphoric acid and potash than ordinary soils.

(24) Tamarind waste is reported to be used as a manure. So the manurial ingredients of a sample of tamarind waste were estimated.

(25) Fumigated seeds received from the Government Entomologist, Coimbatore, were analysed for residual hydrocyanic acid content.

(26) Malt extracts from the Government Malt Factory, Coimbatore, were examined for sugars, specific gravity and acidity. Cholam samples from the same source were analysed for food value.

(27) One sample of tapioca peel received from the Assistant Marketing Officer, Coimbatore, was analysed for food value.

(28) Sixteen samples of red-gram dhall were tested for their protein content, cooking test and flavour.

RESEARCH.

A. Soils.

1. *Rapid tests and their application to the manuring of crops.*— Standardization of the rapid tests for estimating the manurial ingredient content of Madras soils and the necessity for adding

particular fertilizers for maximum crop production was continued. They are being standardized for their suitability for the soils of this State.

2. *Studies on the geochemistry of Madras soils.*—Geochemical studies of the soils of Kollegal show that there are three types of soils in the locality. These are: (1) alluvial, (2) black cotton and (3) red soils. Some of the paddy lands under the big tanks are of alluvial origin as they are found to overlie a bed of sand. The geological formations are gneisses, varying in mineral composition with dykes and veins of amphibolites or pyroxenites. The black soil profile is similar to other black soil profiles of Madras. The black soil is highly clayey, the finer fractions forming more than 80 per cent of the soil. The red soils of Kollegal are associated with acidic gneisses and are similar in profile characteristics to red soils of similar origin elsewhere. The sandy fraction contains a large amount of angular quartz, magnetite, a few bits of augite and alkali felspar. The sand fraction of the black soil does not contain magnetite or alkali felspar and the quartz grains are slightly rounded and abraded. Concretionery gravel composed of ferruginous calcium carbonate and organic matter are found to constitute about 8 per cent of the sand. These factors indicate the transported nature of the black cotton soils of Kollegal.

The chemical composition of the clay separated from the black and red soils are given below :—

(1)	*Black soil clay.* (2)	*Red soil clay.* (3)
	PER CENT.	PER CENT.
1 Moisture	7·77	4·77
2 HCl insoluble matter	57·63	45·98
3 Hydrofluoric acid residue in (2)	6·85	11·95
4 Free quartz and unweathered minerals in (2)	18·02	13·67
5 Soluble silica	39·61	31·91
6 Iron (Fe 203)	8·40	11·80
7 Alumina (Al 203)	11·90	21·65
8 Combined Si 02/Al 203 molar ratio	5·64	2·51
9 Combined Si 02/R 203 molar ratio	3·90	1·79

From the results it is seen that the black soils of Kollegal differ from similar soils in Madras in containing a high amount of unweathered silicate minerals. The unacted minerals in the black soils consist of quartz, felspar and hornblende while the red soils contain some quartz with a large amount of amorphous minerals like leueoxenes.

3. *Geological formations in the Lower Bavani Project area.*—During the course of the soil survey of the Lower Bhavani Project area the geological formations were studied. The main rock

formations are schistose gneisses showing a very great mineralogical variation. The minerals met with round about Satyamangalam are quartz, felspars, muscovite, biotite, hornblende, pyroxenes, hermatite, magnetite, limonite, talc, garnet, serpentine, calcite and magnesite. Basic dykes and pyroxenites are seen on the Kumarapalayam hills (about 1½ miles from Satyamanglam). There are three occurrences of talc within three miles of Satyamangalam. Magnesite occurs as small veins at about 2½ miles on the Satyamangalam-Mettupalayam Road. About a mile from Bhavani on the Bhavani-Gobichettipalayam road there is a very interesting rock composed of quartz, felspar and mica the individual crystals being more than 9 inches broad. In the ayacut area there are soils which contain kankar and soils which do not contain any kankar. The whole of the project area consists of shallow red soils loamy in texture. There are patches of sandy soils also.

4. *Investigation of "Cholam Effect" and the changes in the physico-chemical properties of the black cotton soil brought about by various crop rotations.*—The harmful effect of irungu cholam on the cotton succeeding it in crop rotation is called the "Cholam Effect". In order to find out the cause of the "Cholam Effect" a comprehensive rotation experiment with 16 treatments and four replications for each treatment was laid out in the Agricultural Research Station, Koilpatti. Soil samples from the treatments were analysed before the sowing and after the harvest of each crop for physico-chemical properties such as mechanical composition, base exchange studies, capillarity, apparent and absolute specific gravity, pore space, water holding capacity, volume expansion, etc. The results obtained proved clearly that a rise of soda during the growing season of the cholam crop as suggested by previous workers, cannot be the cause of the harmful effect of irungu cholam on the succeeding crop. The data so far obtained are not quite adequate in correlating the change in the physico-chemical properties of the soil with the harmful effect. In view of the need for the strictest economy in the expenditure the Government ordered the discontinuance of the scheme at the beginning of the year. A separate report has been submitted to the Government on the work done so far.

5. *Improvement of marginal lands.*—To improve the fertility level of the extensive areas of marginal and sub-marginal lands available in our state a simple technique involving very little expenditure has been worked out. The method is being worked out in the Agricultural Research Station, Koilpatti, under rainfed conditions and in the T.V.S. Estate, Eruvadi, under irrigated conditions. The method consists in (1) applying phosphoric acid 30–45 lb. per acre in the form of superphosphate; (2) raising a suitable leguminous fodder crop on the land after inoculating the seed with the specific bacterial culture; (3) cutting the first flush of the legume crop if the growth is vigorous and ploughing in the

second flush. If the growth is not vigorous no cutting is made and the entire crop is ploughed in ; and (4) raising a grain or cash crop after the legume has been incorporated into the soil. The application of the phosphatic manure to the legume enhances its growth and enables it to fix more nitrogen from the atmosphere. Since the legume is ploughed into the soil and undergoes decomposition all the three essential plant nutrients become mobilized in the soil and become useful for the succeeding grain or cash crop If the technique is repeated three to five times the fertility of the marginal land improves and it becomes fit for crop production. The experiment was tried with pillipesara as the legume at Koilpatti but on account of the failure of the monsoon the experiments were inconclusive and will be repeated this year.

6. *Bhairavanitippa Project Soil Survey—A minor irrigation project soil survey.*—To rehabilitate a region in the Ceded districts (on either side of the river Hagari in the Bellary and Anantapur districts) which is threatened with famine almost every year a minor irrigation project has been proposed by the Government. The waters of the river Hagari are to be harnessed by throwing a dam across the river at Bhairavanitippa. The reservoir will have a storage capacity of 2,000 million c. ft. and 8,000 acres on either side of the river are to be irrigated. The water and the soils commanded by the project were examined in the field by conducting a rapid traverse and soil survey. Forty-two profile pits were dug and 112 samples of soil were collected from the pits for analysis in the laboratory. Eight samples of water were also drawn and brought to Coimbatore for complete examination.

Analysis revealed that the irrigation water contains a high amount of soluble salts with sodium as the main action. The chief soil type of the area is shallow red soil loamy to gravelly in texture. There are patches of deep red, black and alkaline soils in the ayacut area. The main soil type, i.e., the loamy shallow red soil is suitable for irrigation.

Under normal circumstances Hagari water containing appreciable amounts of sodium salts cannot be recommended for irrigation purposes. But under the peculiar conditions obtaining the project area where scanty and uncertain rains frequently entail famine conditions and where the main soil type is open in texture and with good drainage possibilities it was recommended that the project may be proceeded with and that irrigation with Hagari water may be undertaken with precautions and adjustments.

A separate report with complete analytical data, profile descriptions and maps has been submitted to the Government.

7. *Estimation of exchangeable calcium in calcareous soils.*—The two methods generally employed for the estimation of exchangeable calcium in calcareous soils are Hissink's sodium chloride method and Kelly's alcoholic potassium chloride method. Both

the methods give fairly satisfactory results but are tedious and time-consuming. So a simple method has been worked out in my laboratory. It is the presence of free calcium carbonate in the soil and its solubility in the leaching solution which are responsible for the erroneous results obtained for exchangeable calcium in calcareous soils. If calcium carbonate is rendered insoluble any salt solution may be used for the leaching out of the exchangeable calcium. It has been found that calcium carbonate is practically insoluble in N. ammonium acetate solution adjusted to pH 8·5 with ammonia. When N. ammonium acetate solution adjusted to pH 8·5 is used as the leaching agent exchangeable calcium may directly be estimated in the leachate even in the case of calcareous soils. The results obtained by this simple method compare favourably with Hissink's or Kelley's method.

8. *Exchangeable bases in a soil containing free calcium carbonate and gypsum* —There is no satisfactory method for the estimation of exchangeable bases in a soil containing free calcium carbonate and gypsum. So a method has been worked out for such soils as a result of a large amount of preliminary work. The method consists of several steps. The first step consists in the removal of soluble salts such as the chlorides, carbonates, bicarbonates and a part of the sulphates by washing with 40 per cent alcohol adjusted to pH 7·0. The washed soil is then digested with excess of barium acetate or hydroxide solution to precipitate out all the sulphate including gypsum. The excess of barium is then removed from the system by passing carbondioxide into it and warming. The treated soil is then leached with N/2 ammonium acetate solution adjusted to pH 7·0 to remove all the exchangeable bases. In the leached soil the base exchange capacity is determined. In the leachate magnesium, sodium and potassium are estimated after the elimination of ammonium salts. Exchangeable calcium is obtained by difference, i.e., by subtracting the sum of exchangeable magnesium, potassium and sodium from the base exchange capacity of the soil.

9. *Phosphate studies in laterite soils.*—It is a well known fact that soluble phosphates added to laterite and lateritic soils become reverted in a short time and are not available to plants. Investigation on the phenomenon in all its aspects has been started with a view to prevent or check the reversion and to utilize, if possible, the phosphates that already exist in such soils in an insoluble condition.

10. (*a*) *Reclamation of alkali lands in the Cauvery-Mettur Project area.*—There are hundreds of acres of alkal land awaiting reclamation in the Cauvery-Mettur Project area. With an assured supply of irrigation water of good quality, it should be possible to grow good crops here once the reclamation is effected. Experiments to reclaim these soils were started in 1948 49. These were continued

this year. Samples of soil were collected to a depth of one foot in all the 80 plots immediately after harvest in February 1950 and analysed for alkalinity and pH. The results are tabulated in Tables 1 and 2. From the results it is seen that (1) gypsum alone has not proved beneficial in bringing down the pH; (2) gypsum plus green leaf is very erratic in behaviour; and (3) a thorough reclamation is possible with green leaf (5,000 to 7,500 lb.) or molasses (2½ to 5 tons) or gypsum 2½ tons plus green leaf 5,000 lb. per acre.

The crop yields of grain and straw obtained in December 1950 do not show any significance of the treated plots over the control. The post-harvest samples of soil taken in 1951 are under examination.

S.R.26.B, a saline-resistant variety of paddy was also grown on a bulk scale to compare its performance with Co. 25. This was better than Co. 25 and is of shorter duration.

(*b*) *Reclamation of alkaline soils—Agricultural Research Station, Hagari.*—For the purpose of this study, 32 samples of soils were collected from four profile pits up to eight feet depth in field Nos. G. 4, G. 10 and G. 14 stated to be alkaline by the Superintendent of the Agricultural Research Station, Hagari. The samples of soil were analysed for their mechanical composition, alkalinity and pH. Water samples, were also drawn from the three sources, viz., (1) pumping station well; (2) G. 4 well; and (3) underground water in the profile pits in G. 4 field and analysed for alkalinity.

From the data obtained (Tables 53 and 54), the following observations and recommendations were made:—

(1) Except the G. 4. field, all the others contain salts in increasing quantities. The G. 4. field alone shows that the salts are accumulated in the first three feet and that they decrease with depth. From a reference to the mechanical composition of this field it is evident, that the finer fractions decrease with depth and the coarser fractions *vice versa*. There is thus no possibility of rise of salts in this field and the salt accumulation could be reduced. Without much difficulty since the water would percolate to lower depths only. Advantage may be taken of this fact and the land parcelled out just prior to rains into small plots with high bunds and drains along the contour so that the rain water collecting in the plots could remove the salts and percolate into the drains. The field having a good slope, this operation could be done easily.

(2) In regard to the other fields G.7, G.10 and G. 14, the salt accumulation is considerable at lower depths especially in Field G. 14 since the finer fractions have been found to increase with depth in these fields due to infiltration of clay with salts, etc., during rainy season into deeper layers, with the consequent upward movement evidently of the soluble salts when the weather is dry, resulting in their greater concentration in the surface layer, the reclamation of these fields is not so easy as in the case of G. 4.

The removal of salts from these soils needs as a first requisite good water of low salt content. As this is not available in the station, the only remedy is a heavy application of all kinds of farm wastes such as leaves, cotton stalks stubbles, groundnut shells, etc., together with ammonium sulphate calculated at 1 per cent on the total weight of material to be applied just prior to the onset of the monsoon. The quantity of wastes, etc., applied should not be less than 20 tons per acre and if more of these could be applied the reclamation will be quicker. In the event of the monsoon failing, the decomposition of the materials would be retarded and irrigation may be given with water from the pumping station which contains less of soluble salts than the water from G. 4 well which is unsuitable for irrigation. The object of the application of the wastes in preference to easily decomposable materials like green manure, farmyard manure, is that the former, due to their slow decomposition, would maintain the break of capillary connexion at the surface of the soil for longer periods. Further, the soil would be kept porous for a longer period during the rainy season and thus facilitate easy drainage. In these three fields it is advisable, to grow shallow rooted crops only and not deep rooted ones like cotton for some time to come. Addition of N preferably as ammonium sulphate in sufficient amounts is necessary to the crops, since the soil would be in a nitrogen starved state due to the addition of difficultly decomposable wastes.

(3) The analysis of water samples indicate that the water of G. 4 well is unsuitable for irrigation while the pumping station water contains much less salts. Since a high proportion of the salts is in the forms of chlorides and sulphates of sodium in the water, it has to be used with great caution. Otherwise, the salts contained in the water would be deposited in the field, which would tend to increase the total salt content of the soil with time.

11. *Soil Survey Scheme for Fruit Development in the Ceded districts.*—The scheme was sanctioned in G.O. Ms. 896, Food and Agriculture, dated 12th May 1950. The traverse and soil survey was completed for Bellary and Cuddapah districts. In all 42 profile pits in the Bellary district and 73 profile pits in the Cuddapah district were dug and 235 and 441 samples of soil were collected from these pits for analysis. Thirty-five and 21 samples of water were also collected from Cuddapah and Bellary districts, respectively, for thorough examination in the laboratory.

The water samples have been analysed and the analysis of the soil samples is in progress. The soil survey has been ordered to be suspended from 1st June 1951 for the summer.

12. *Surface run-off on the Nilgiris.*—Aggregate analysis of the soils from the run-off plots at Nanjanad shows that 55·64 per cent of the particles in the top 6 inches layer and 54·41 per cent in the second 6 inches layer consist of particles or of aggregates with less than

2 m.m. diameter. Both the depths contain 45 per cent to 46 per cent of aggregates with more than 2 m.m. diameter. The second foot sample of soil contain 36·73 per cent of aggregates smaller than 2 m.m. diameter and 63·27 per cent of aggregates with diameter more than 2 m.m. So in these soils there is bound to be quick absorption of rain water and very little of surface run-off.

13. (*a*) *pH in paddy soils.*—Soil samples drawn at fortnightly intervals and kept stored from the plots of twelve different treatments under Maximum Potentialities Experiments at the Paddy Breeding Station, Coimbatore, were subjected to analysis for total nitrogen, nitrate nitrogen and ammonical nitrogen. The first round of analysis indicates that practically the whole of the experimental area is uniform in respect to nitrogen availability. In the second round higher values for total nitrogen are obtained showing that the decomposition of organic matter has set in. The cropped plots give lower values indicating the absorption of nitrogen by the plants. The nitrogen intake in the different treatments appears to vary. The following table gives the nitrogen intake in the different treatments :—

	MILLIGRAMS.
Control	8·6
Leaf alone	28.2
Leaf + 30 N.	12·9
30 P_2O_5	17·9
Leaf + 30 P_2O_5	8·2
Leaf + 30 P_2O_5 + 30 N	14·6
60 K_2O	3·4
Leaf + 60 K_2O	0·4
Leaf + 60 K_2O + 30 N	3·8
30 P_2O_5 + 60 K_2O	0·2
30 P_2O_5 + 60 K_2O + Leaf	18·6
30 P_2O_5 + 60 K_2O + 30 N	2·5

Thus it is seen that there is not only seasonal fluctuation but also fluctuation in the different treatments. Potash application appears to depress the in-take of nitrogen.

(*b*) *Effect of green manures on the physico-chemical properties of soils.*—This study was started in the A and D blocks of the Central Farm, Coimbatore, where green manure experiments were carried out and soil samples are drawn every month. They were analysed for pH and conductivity. Periodical analysis was also made for other factors like maximum water holding capacity pore space, real and apparent specific gravity and nitrogen. The results are tabulated in Table 3.

(*a*) *Fluctuations of pH* (i) *In relation to season.*—During the growing period of the crop two maxima and one minimum are noted in the pH values of the soil. The maximum occur in August and January and the minimum in September.

(ii) *In relation to treatment*.—The application of green manures tends to lower the pH of the soil and the various green manures differ to some extent with regard to their influence. Pillipesara has the greatest effect in lowering the pH (1·89 pH units) followed by daincha, cowpea and sunnhemp in the order given. The seasonal variation, however, is more pronounced than treatment variations (Table 3).

(*b*) *Specific conductivity*.—D block soil contains more salts than the A block soil. The salt status of the soils show two maxima, one in September and the other in January and one minimum in October-November. The variation in the salt content of the soils can be correlated with the decomposition of organic matter in the soil and with the metabolic activities of the crop (Table 4).

(*c*) *Aggregate analysis*.—The water stable aggregates in the sunnhemp plot were estimated and found to consist chiefly of aggregates with diameter less than 1 m.m.

(*d*) *Nitrogen content*.—The nitrogen contents of the treated plots vary considerably all the green manures enriching the soil. Daincha confers the maximum benefit followed by sunnhemp, cowpea and pillipesara in the order given.

(*e*) *Physical constants*.—The correlation between the physical constants and the green manure applied is not very definite. The physical constants included the apparent and absolute specific gravity, the pore space and the water holding capacity of the soil.

14. *The study of the colour of south Indian Soils*.—The general correlation between the colour of the soil and the molar ratio of the mono and divalent bases to the iron oxide observed in previous studies was found to hold good in the soils examined during the year. Similar relationships were traceable in the case of the total exchangeable bases and the absolute specific gravity (Tables 5 to 10).

15. *Irrigation experiments on the black cotton soils of the Tungabhadra Project, conducted at the Agricultural Research station, Siruguppa*.—After the closure of the chemical laboratory at Siruguppa the soils drawn from the various experimental plots are analysed by the Chemical Assistant (borne under the budget head of Irrigation, Navigation and Embankment research) working at Coimbatore.

During the year, 172 samples of soil and 74 samples of water were analysed. The details of the experiments and the conclusions arrived at are given briefly below :—

(i) *Experiment on the effect of light irrigation on the movement of water soluble salts*.—This fundamental experiment was started in 1939 in Block III, field (1) and has for its object the study of

the effect of continued light irrigation of different types on the movement of salts. The irrigation treatments studied are the ryots' method, 2 inches of irrigation in 15 days, 3 inches in 15 days 3 inches in 30 days and these are compared with no irrigation. The summary of the results are given in Tables 11 and 12. The results indicate that there is no rise of salts in the soils and that the different irrigation treatments show less salts in the top three feet of soil than the "no irrigation" plots (Tables 11, 12 and 18).

(ii) *Studies conducted on the effect of heavy irrigation on the black soils.* Heavy irrigation experiments of the black soils under different wet land cropping systems such as the single crop paddy, sugarcane-paddy rotation and double crop are being conducted in block V of the station since 1939 to study the movement of the salts. The detailed results are given in Tables 13, 19 and 21) From the results it can be concluded that (1) there is no increase in salt content or the degree of alkalinisation of the top three feet of soil studied ; (ii) on the other hand there is a definite reduction in the salt content compared to the pre-irrigation figures.

(iii) *Effect of crop rotation and light irrigation on the movement of salts.* -These experiments were started in 1949–50 in block VIII, Field Nos. 7 and 14. The plots are under a four course rotation of cotton, wheat or korra, jonna, groundnut and redgram. Soil samples are drawn once a year after the harvest of the crops down to 3 feet and analysed for total soluble salts. The analytical data are presented in Tables 14, 20, 22 and 23. The results show that there is no harmful effect in the form of an increase in alkalinity due to crop rotation and light irrigation.

(iv) *Analysis of pre and post-irrigation soils for the degree of alkalinisation.*—The effect of light and heavy irrigations on the degree of alkalinisation was studied with the pre and post-irrigation soils from Block V, wet lands and Block III, garden lands. The results are given in Tables 15 and 16 and 21. From the results it can be seen that the degree of alkalinisation of the soils are within safe limits. Irrigation, light and heavy has only reduced the degree of alkalinisation of the soils.

(v) *Analysis of irrigation and drainage waters from the wet lands.*—As usual eight samples of irrigation water from the Tungabhadra river and the Siguppa channel were analysed every month for 9 months from July to March. The irrigation water was compared with the drainage water from the wet lands and it was found that about 52 per cent more of salts are removed from the soil in the drainage water. The salts thus removed consist of calcium bicarbonate, sodium chloride, carbonate and sulphate (Table 17).

From the results so far obtained of the experiments carried out in the Agricultural Research Station it is seen that light or heavy irrigation given to the black soils do not bring about an

accumulation of salts in the surface soil or increase its degree of alkalinization. But the area under investigation is now situated in the midst of a land mass which is dry. What will happen when the whole area comes under irrigation cannot be predicted. So the conclusions so far obtained as to the irrigability of the black soils must not be taken as conclusive.

B. Manuring and Plant Nutrition.

1. *Permanent manurial experiments.*—These trials have been continued with different crop rotations for the study of the effect of continuous cropping on soil manured with cattle manure and artificials supplying nitrogen, phosphoric acid and potash singly and in combination in the same manner year after year.

(*a*) *The old permanent manurial experiments.*—Cambu was grown in the plots under rainfed conditions. The plots were manured as usual and the crop sown on 20th August 1950. The germination was satisfactory. The vegetative growth was the best in the cattle manure plot and average in the others except 'P' and 'K' plots. The crop flowered during the first week of October but the setting was not satisfactory. The crop was harvested on 28th November 1950. The yield was poor owing to the persistent drought conditions during the growing period of the crop. The yield of grain and straw from the different treatments are given below :—

Treatment.	*Yield per acre*	
	Grain lb.	*Straw lb.*
1 No manure	166	1,293
2 N	131	1,278
3 N + K	178	1,030
4 N + P	284	1,373
5 N + K + P	284	1,468
6 K + P	142	1,016
7 K	142	914
8 P	178	980
9 Cattle manure	78	2,333
10 Cattle manure residual	144	650

The yield of grain was the lowest in the cattle manure plot and the highest in the N + K + P and N + P plots. The straw yield was the highest in the cattle manure plot.

(*b*) *New permanent manurial plots.*—In these plots there are 10 treatments and two replications for each treatment. The crops are grown with irrigation. Two crops are taken year after year.

The first crop this year was ragi and the planting was carried out between 26th and 28th June 1950. The crop flowered in the second week of September 1950 and was harvested

during the second week of October. The yield figures for grain and straw are tabulated below :—

Treatment.	Acre yield in lb.			
	Eastern series.		Western series.	
	Grain.	Straw.	Grain.	Straw.
1 No manure	219	490	49	141
2 N	97	267	73	207
3 N + K	97	270	122	255
4 N + P	486	641	413	411
5 N + K + P	705	607	851	705
6 K + P	486	559	681	680
7 K	122	279	365	462
8 P	486	559	730	948
9 Cattle manure	340	559	365	729
10 Cattle manure residual.	97	236	267	485

Between the two series of plots, eastern and western, the western series with the exception of plots 1 and 2 have shown better performances. In both series the N+K+P plots have given the highest yield of grain followed by 'N+P' and 'P' plots. The straw yields are the highest in the 'P' plot of the western series and the 'N+P' plot of the eastern series.

The second crop raised in the New Permanent Manurial plots was summer cholam (Co. 9). The sowing was done in February 1951 and the germination was fair in all the plots. The stand of the crop was good in all plots except the 'No manure' 'N' and 'N+K' plots of the eastern series. The crop was attacked by earhead bugs in the first half of May 1951 but due to the prompt dusting with gammexane the damage caused was not much. The crop was harvested on the 4th and 5th of June. The yield figures are tabulated below :—

Number.	Treatment.	Acre yield in lb.			
		Eastern series.		Western series.	
		Grain.	Straw.	Grain.	Straw.
(1)	(2)	(3)	(4)	(5)	(6)
1	No manure ..	850	3,890	750	4,497
2	N	750	3,205	1,275	4,110
3	N+K	1,250	3,550	1,475	4,110
4	N+P	2,387·5	5,180	2,450	5,282·5
5	N+K+P ..	2,625	4,960	2,650	5,427·5
6	K+P	2,325	4,680	2,525	5,395
7	K	1,225	4,065	2,012·5	4,700
8	P	2,275	4,407·5	2,500	4,935
9	Cattle manure ..	2,425	4,810	2,537·5	4,142·5
10	Cattle manure residual.	912·5	4,080	2,025	5,657·5

As with the previous crop the western series of plots gave better performance than the corresponding plots of the eastern series.

In both series the increase in yield over the control is significantly high, the N+K+P plots topping the list with regard to grain yield. The cattle manure plots and the 'N+P' plot of the eastern series and the 'P' plot of the western series come next. As regards straw the N+P plot gave the highest yield followed by N+K+P plot in the eastern series while the Cattle Manure Residual plot gave the highest yield followed by the 'N+K+P' plot in the western series.

From the yield data of the New Permanent Manurial plots it would appear that —

(1) the application of phosphate has increased the yield of grain in both series over the 'no phosphate' plots ;

(2) the complete fertilizer plots (N+K+P) gives better yields than cattle manure plots which were, however, the next best ; and

(3) potash does not appear to have any effect increasing the yield in the plots.

2. *Green manuring of paddy.*—The C/N ratio of the orginal and residual soils from the pot culture experiments was determined. The results are given in Table No. 24.

The results show (1) there is an increase in organic carbon in the green manured cropped pots. This is in accordance with the findings of other investigators. In ammonium sulphate single dose (Treatment V) the carbon content is maintained whereas in all other treatments than those mentioned above there is a loss of carbon. (2) There is no appreciable change in nitrogen content except in the last three treatments where an appreciable increase is noted. These treatments contain nitrogen equivalent to 10,000 lb. of green leaf. (3) The C/N ratio is lowest in combination of green manure and ammonium sulphate, lower than the original soil ; it is maintained at the same level in no-manure uncropped and cropped, ammonium sulphate single dose cropped and ammonium sulphat double dose. In green manure uncropped and cropped, ammonium sulphate single dose uncropped and green manure double dose, the ratio is increased.

3. *Reduction of manurial bill for potatoes—Experiment at the Agricultural Research Station, Nanjanad.*—The object of the experiment is to explore the possibilities of reducing the dosage of manure now advocated for potatoes in the Nilgiris without impairing the efficiency of yields or the productive capacity of the soils. This is the second year of the scheme.

The experimental scheme is as below :—

(1) No lime (Series).

(2) Lime at 2 tons per acre (Series).

(3) Nanjanad Mixture (Control)2 : 5 : 3.

(4) Reduction of 2N to 1N keeping P and K constant.

(5) Reduction of 5P to 3P, 1P and O keeping N and K constant.

(6) Application of 60 lb. of P205 to lupin preceding potato.

In Series II a cereal crop of samai and a green manure crop of lupin were raised in the previous year in the experimental plots. Lupin was grown with and without P205 at 60 lb. per acre. Immediately after lupin a second crop of potato was planted in Series II on 31st March 1950 and was harvested in the third week of September 1950. The yield figures are given in Table 25.

On the same lines the experiment is repeated in Series I for the third year. The sowing of potato was done on the 7th and 8th of May 1951. The experiment is in progress.

From the yield data of the second year the following conclusions can be drawn.—

(i) The Nanjanad mixture containing 2N—5P—3K has given the highest yield.

(ii) Lime has influenced increased yield when the nitrogen level is low.

(iii) Increased dosage of phosphoric acid gives increased yield;

(iv) Effects between the treatments are not generally statistically significant.

(v) Statistical significance is, however, attained for the main effects of P205 and its interaction with nitrogen (vide Table 26).

However, it may be mentioned that the seasonal factors were not satisfactory throughout the Nilgiris and poor yields were generally recorded. The experimental plots suffered from the same adverse conditions. The average acre yield of potatoes from the plots receiving Nanjanad mixture was 8,660 lb. This is only 57 percent of the previous year's yield.

Economics of the yield data (*Table* 27).—When this is worked out it is seen that while Nanjanad mixture gives a small margin of profit of Rs. 103-13-7 per acre the other mixtures show wide margin of loss. However it must be mentioned that in the first year encouraging results were obtained in cutting the manure bill. In the second year the crop suffered from adverse weather conditions and the yields were poor. So the yield of this year cannot be taken as normal and the results of the coming year have to be waited for.

Soil analysis-Post-harvest samples.—One hundred and twenty-eight samples of soil from Series II were collected for analysis. Fifty samples have been completed for chemical analysis, and the examination of the remaining is in progress.

4. *Foliar diagnosis studies.*—This work aims at the study of the relationship of yield to the nutrition of crop plants grown in differently fertilized plants in the permanent manurial plots as indicated by the periodical analysis of the leaves of the same physiological or metabolic age. The work is in progress.

5. *Copper nutrition of plants.*—A study of the copper nutrition of plants was started on cholam and it was found that 20 P.P.M. of copper applied as $CuSO_4$. 5 H_2O influences the yield to a slight extent. A method for the estimation of copper in soils was attempted by modifying Allen V. King's colorimetric method into a gravimetric method. A standard curve for copper as dithizonate was drawn using the photo-electric absorptiometer between the ranges of 0·01 to 1 mgm. of copper.

5-A. *Chemical studies on the phosphate in-take by cholam seeds.* Experiments on the in-take of phosphate by cholam seeds and the germination and growth of the treated seeds were studied. The results are given in table No. 28. From the results it is seen that the maximum amount of phosphate is absorbed in 12 hours and there is no correlation between the in-take of phosphorus and the weight of the plants.

6. *Compost experiments.*—Experiments with nightsoil compost and with farm waste compost to compare their manurial value with farmyard manure were carried out at a number of Agricultural Research Stations. In all cases 'no manure' plots were included to find out the relative efficiency of the manures.

A. Nightsoil compost.

(i) *Central Farm, Coimbatore.*—The experiments were conducted in F. Nos. 68 and 74 under garden land conditions and in K. Block under wet land conditions. Ragi (Co. 1) in F. Nos. 68 and 74 gave lower yields than the no manure treatment while cholam (Co. 9) gave almost identical yields of grain. The results are given in Table 29.

In the wet lands, K. Block paddy yield was higher with the treatments than with control in Series I and night-soil compost proved slightly superior to farmyard manure. In Series II the grain yields were identical in all the treatments while straw yield was the lowest with compost. But the results are not statistically significant. (Table 30). With regard to sugarcane the treated plots gave higher yields than the no manure plots and compost proved superior to farmyard manure (Table No. 31).

(ii) *Agricultural Research Station, Samalkot.*—Plantain was raised with the different manures and farmyard manure was better than compost and this in turn gave a better return than from the no manure plot. (Table 32.)

(iii) *Rice Research Station, Tirurkuppam.*—The trials with town refuse compost conducted in the samba season in the single and

double crop wet lands indicate that compost and farmyard manure gave higher yields than no manure and that farmyard manure is slightly better than compost (Tables 33 and 34).

(iv) *Agricultural Research Station, Lam (Guntur).*—Chillies and Variga were grown with the manures. With chillies significant increase in yield was obtained with both compost and farmyard manure and compost proved more beneficial than farmyard manure. Nith variga the increase in yields were not significant over the no manure treatment (Table 35).

(v) *Sugarcane Research Station, Anakapalle*—Sugarcane gave significantly higher yield over the nomanure treatment with both the manures. There was increased yield with paddy also but the increase does not satisfy the 'Z' test. With both crops compost was better than farmyard manure (Tables 36, 37 and 38).

B. Farm Waste Compost.

(i) *Agricultural Research Station, Maruter.*—The compost experiments were laid out in the single and double crop areas with paddy as the crop. The yield of grain was higher with both crops over the 'no manure' treatment but only the grain yields in the single crop areas satisfy the 'Z' test. Farmyard manure proved slightly better than compost (Tables 39, 40 and 41).

(ii) *Agricultural Research Station, Palur.*—Groundnut (TMV. 4) gave higher yields with both the manures and cattle manure was found to be slightly better than compost.

Ragi (R. 382) and Cambu (Co. 3) gave significantly higher yields over the control. The difference in yield between the two manures was negligible (Tables 42, 43 and 44).

(iii) *Agricultural Research Station, Aduthurai.*—The yield of paddy was found to be significantly higher with the two manures, cattle manure being slightly better than compost (Table 45 and 46).

(iv) *Agricultural Research Station, Pattambi.* -The yields of Katta Modan paddy obtained with compost and farmyard manure were slightly higher than from the nomanure treatment but they are not statistically significant (Table No. 47).

C. Plant Physiology.

The Plant Physiologist was working under my administrative and technical control till the 31st of March 1951. From 1st April 1951 he was transferred to the administrative control of the Principal, Agricultural College and Research Institute, Lawely Road. The report of the work done by the Plant Physiology section during the year will be submitted by the Plant Physiologist.

D. Bacteriology.

1. *Biological activities of differently manured soils of the old permanent manurial experimental plots, Coimbatore.* -Samples taken from the "no manure", "N+K+P", and "cattle manure" plots were analysed on two occasions during September 1950 and April 1951 for total bacterial population. The results recorded in Table 48 indicate that the "cattle manure" plot was the highest in the bacterial population followed by "N+K+P" and "No manure" plots in the order, in the samples analysed in September 1950. In the later sampling "cattle manure" plot had the highest bacterial population and there was very little difference between the other two treatments. These results indicate the importance of organic matter for bacterial activity and the maintenance of their number at the high level.

The soils from the three treatments were also analysed in May 1951 for their biological activity with reference to the utilization of glucose (one per cent) added to the samples. The data (Table No. 49) reveal that the activity is poor in the "no manure" plot while in the other two, "N+P+K" and cattle manure it was almost equal in the absence of glucose. The response to the addition of one per cent of glucose in regard to activity was, however, negative in the "cattle manure" plot and markedly high in the sample from "N+P+K" plot. This again emphasizes the need for organic matter to maintain biological activity at a high level even in the case of soils receiving complete artificial manure.

2. *Micro-biological activities of red and black soils.*—Studies were undertaken to find out the variation in bacterial numbers and biological activity in the two types of soil found in the Central Farm, Coimbatore. in the Cotton Breeding Station, Coimbatore. and in the Pulse Specialist's fields. The data for total microbial population in the samples of red soil and black soil collected after the harvest of the standing crops and analysed during April 1951 (Table 50) show that the bacterial number was more in the red soils than in the black soils and that the plots under Pulse crops were superior to those under cereals like cholam.

It was also found (Table 51) that the addition of one per cent of dextrose was necessary for bringing the biological activity in the red soils to the level of the black soils. This shows that the limiting factor in the red soils for biological activity is the absence of readily available energy producing materials like dextrose. Further the red soils from the Cotton Breeding Station, Coimbatore, are definitely poorer than the corresponding red soils from the Central Farm. Depending on the extent of biological activity in the different types of red and black soils the addition of organic matter may be advocated for the maintenance of soil fertility.

3. *Biological activities of soils from different profiles in the Pulse Sub-station, Vizianagaram.* -In connexion with this investigation, samples or soils were drawn at one foot intervals up to

3 feet depth from the various parts of the Farm area which is mostly of deep and red loamy type: and analysed for their biological activities. The addition of one per cent dextrose to the soil samples increased the biological activity considerably, indicating the deficiency of organic matter, especially readily available energy material, in the soils of the Farm. The results also reveal (vide Table 52) no difference in the biological activity of the soils from the three depths of the various profiles.

E. Legumes.

1 The four leguminous green manures tried in the year were daincha, pillipesara, sunhemp and cowpea. The south-west monsoon was a failure in Coimbatore and the sowing of the green manure crops in the A and D blocks of the Central Farm was delayed considerably especially in the D block. After germination no water was available for the life irrigation of the crops. Consequently the growth of the green manure crops was poor in D block except for daincha. It is only about one third of that obtained last year. With daincha the reduction is about 14 per cent. In A block the growth of the legumes was below normal especially with cowpea. The growth in D block satisfies the 'Z' test but not that in A block (Table 56).

2. *Paddy yields obtained by incorporation of green manures.*—Compared with last year the yield of paddy was better in the A block than in D block. In D block it is poorer by about 15 to 20 per cent. The increase in yield due to green manuring is higher in the A block than in D block. The results for both grain and straw in the A block and grain only in the D block satisfy the 'Z' test. In A block pillipesara gave the highest yield followed by daincha, sunnhemp, and cowpea. In D block daincha and pillipesara were the best followed by pillipesara and sunhemp (Table 57).

3. *Nitrogen fixation by legumes.*—The values for nitrogen fixation in A block was poor compared with last year. In D block fixation of nitrogen by all the green manures except daincha, was extremely poor due to adverse seasonal conditions. The results are given in Tables 58 and 60.

4. *Succulency and decomposability of the legumes.*—Pillipesara and cowpea are the most succulent of the green manures and the other two daincha and sunnhemp are relatively resistant. The stem to leaf ratio is the highest with pillipesara followed by sunnhemp in the A block whereas in D block pillipesara is followed by cowpea. The decomposability is most with cowpea followed by pillipesara and sunnhemp. Daincha is the most resistant of all the four legumes. The results are given in Table 59.

5. *Biological activity and bacterial counts of green manure trials.*—A maximum bacterial population was obtained during the growing period of the green manures. Daincha topped the list

followed by pillipesara, sunnhemp and cowpea. The effect of green manuring was observed in the sub-soil also. Biological activity was highest in the samples drawn after the harvest of paddy. Sunnhemp was found to be the most effective in this respect followed by cowpea in the case of surface soils and pillipesara in the sub-soil.

The results obtained in D block were similar to those in A block. The results are tabulated in Table No. 61.

6. *Associated growth of cereals and legumes.*—The yields of cholam and other crops in the associated growth was better than last year. It was found that with red gram a ratio of $\frac{3}{4}$ cholam + $\frac{1}{4}$ pulse gave the maximum yield of both crops together and had the highest economic return. In the case of greengram which was smothered by cholam an increased ratio of pulse to cholam was found better. With blackgram a ratio of $\frac{1}{4}$ pulse + $\frac{3}{4}$ cholam gave the best yield but the highest economic return was obtained when sown in equal ratios (Table 62).

The analysis of the soil in the various plots revealed a loss of nitrogen in the surface soil and its migration into the sub-soil.

7. *The effect of green manures on the physiological characters of the paddy plant.*—The effect of green manure on the height, number of tillers, distance between plant to plant, length of panicle, number of grains, etc, was studied in both the A and D blocks of the Central Farm, Coimbatore. The paddy crop in the daincha plots made the maximum growth followed by pillipesara, sunnhemp and cowpea in the A block In D block the height of the paddy plants was the higgest in the daincha plots but due to an attack of blast the number of earheads developed was next to sunnhemp. Pillipesara came third and cowpea last (Table 63).

8. *Analysis of plant products.*—The analysis of the plant parts of the associated growth of legumes and cereals of 1949-50 were completed. It was noted that the composition of the materials did not show any material difference either on account of the green manure grown or the ratio of pulse to cereal (Table 64).

9. *Supply of legume cultures.*—Three hundred and four legume cultures were supplied to the various Agricultural Research Stations and private individuals during the year. The list of the cultures is given in Table 65.

10. *Training.*—Reported under Teaching.

11. *Number of samples analysed.*—633. Detailed in Table 55.

F. Agro Industries.

1. *Study of antioxidants.*—The study of the effect of antioxidant on the colour and the keeping quality of jaggery was continued

this year. Wheat flour at 0·5, 1·0 and 2·0 per cent on the final output of jaggery was added to cane juice and boiled down to jaggery. There was no improvement in the colour of the three samples due to the addition of the antioxidants. It did not also improve the keeping quality.

Wheat flour at 2 and 3 per cent on the weight of the jagger was used as an external coating to ascertain whether it improves the keeping quality of the jaggery. It has not only no beneficial influence but also causes the jaggery to become easily susceptible to fungal attack.

2. *Fungal diastase.*—Two strains obtained from Bangalore and New Delhi were examined for the growth characteristics and diastatic activity. The strain N.C.T.C. 595 from New Delhi showed higher diastatic power. The growth was also more rapid and heavier than N.C.T.C. 558 in solid and liquid media (Table Nos. 66 and 67)

Preservation studies on ghee.—Experiments on the keeping quality of ghee (at 37°C) prepared according to different methods were started in the year. Ghee samples were prepared by heating pure cow's butter from the College Dairy to different temperatures like 110°, 120°, 125°, 130° and 135°C and the lengths of time for which they kept well in the electric incubator at 37°C when partially exposed to air was noted. Different chemical values like moisture, acidity, peroxide value, iodine value, saponification value and the tintometer reading for the modified Kreiss test were determined in the samples. The lipoid phosphorous content in some of the samples was also estimated. The values for another set of samples in which the curd had been filtered away were also determined. In order to have a comparative idea of the degree of deterioration a portion of each of the above mentioned samples was kept in the Kelvinator and the above values determined. The studies are still in progress but from the results obtained the following tentative conclusions can be drawn:—

(1) A temperature of 135°C for the melting of butter appears to be desirable.

(2) The presence of curd is essential not only at the time of melting butter into ghee but also in the stored product to prevent rapid oxidative changes.

(3) Even small amounts of curd appear to retard the oxidative changes.

(4) Peroxide value is not a sufficiently sensitive test to detect the changes till the flavour has become distinctly bad.

(5) Acidity figures and modified Kriess test by themselves are not of much use in estimating the degree of oxidative changes in ghee or even in the detection of the onset of rancidity.

(6) The phosphorous content (lipoid phosphorous) of ghee influences the keeping quality but more data have to be collected to confirm this.

(7) Oxidative changes take place even in the samples kept at low temperatures as for example when kept in the kelvinator but the date of deterioration is slower than under ordinary atmospheric conditions.

(8) The maximum duration for which ghee samples remained in good condition when stored at 37°C. was 40 days. During this period there was not even the faintest off-odour in the sample prepared by melting butter at 135°C.

G. Miscellaneous.

Quality of green manured rice.—A new experiment to assess the quality of green manured rice was started in 1949-50 and completed in 1950-51. A poor quality rice Co. 13 was grown under different manurial treatments : no manure, green manure at 10,000 lb. per acre and ammonium sulphate the nitrogen level being equal to that in the green manure. The quality of the rice was determined estimating the food values and by studying the quality of the starch prepared from the grains. Pure starch was prepared from the grains obtained under the three treatments and the granule size of the starches was measured. Five hundred granules were measured in each case under standard conditions. The results of the measurements are given in Tables 68 and 69 and the feeding values in Table 69. It will be seen from the results that though variation in frequency distribution are fairly uniform throughout the entire step interval of frequencies in all the three starches, in the green manured rice there is a greater number of granules of lower sizes than in the other two treatments with a consequent reversal of the position in the higher sizes. The phenomenon was found previously as a factor of quality in rice. It is also seen that green manured rice contains more proteins, ether extractives, potash and phosphoric acid. It was tentatively concluded from these studies that rice manured with organic manures (green manure) appears to be of superior quality to that obtained with a mineral fertilizer (ammonium sulphate). Further experiments will be carried to test the validity of these findings.

2. *Supply of manurial data.*—Manurial data of this State on phosphates and on general manures were supplied to Dr. S. Das, Chief Chemist, Phosphate Monograph New Delhi, and to Sri C. Annamalai, Special Officer (Propaganda), Board of Revenue respectively.

Publications.—The following papers were submitted for publication during the year :—

(1) "Pre-treatment—a new aid for improving crop yields" by Sri T. R. Narayanan, Plant Physiologist.

(2) "Soil Conservation and Maximization of Crop Production" by late Dr. A. Subba Rao, Sri F. L. Daniel and Sri S. Varadarajan.

(3) Organic *versus* Inorganic Manures by Sri P. D. Karunakar.

(4) Studies on the green manuring of paddy by Sri E. J. Verghese, Sri M. Sanyasi Raju, and Sri P D. Karunakar.

(5) Quality of green manured rice by Sri E. J. Verghese.

(6) Estimation of Exchange Soda in Black soils by Sri P. Kunhirama Menon.

(7) A Note on a method for the estimation of exchangeable bases in black soils containing calcium carbonate and gypsum by Sri P. Kunhirama Menon and Sri M. P. Sankaranarayanan.

(8) Role of Organic Manure and Inorganic Fertilizers on soil fertility by Sri M. Sanyasi Raju.

(9) Manuring of Lemmes by Sri M. Sanyasi Raju.

(10) Leaflets on "Soil Survey", "Reclamation of alkali soils" and "Green manuring of paddy" were submitted to the Director of Agriculture.

(11) A number of news letters on the various aspects of the activities of the section were submitted to the Director of Agriculture.

Exhibition and exhibits.—The section participated in the S.I.A.A. Park Fair Exhibition held in Madras in December 1950 to January 1951. Exhibits were also sent to various exhibitions at various places held during fairs and festivals.

Visitors.—The following were some of the distinguished visitors to the section during the year :—

(1) Miss Marry A. Toronga from United States of America.

(2) Brig.-General Ponnappa and Mrs. Ponnappa.

(3) Dr. Muntzig of Sweden.

(4) Sri R. Suryanarayana Rao, M.L.C.

(5) Sri Anantaraman, I.C.S., Director of Fisheries.

(6) Sri T. M. Gopal Chetty, Cotton Broker, Bombay.

(7) Sri Gajanan Naik, Palm Gur Advisor, Government of India.

(8) Sir John and Lady Russell.

(9) Dr. Edelman, Professor of Soil Science, University of Holland, Amsterdam.

(10) Delegates to the First Biennial Sugarcane Growers' Conference.

(11) Dr. J. K. Basu, Soil Physicist to the Government of Bombay.

(12) Sir T. S. Venkataraman, retired Government Sugarcane Expert.

(13) Professor Woon Young Chun and two delegates of China.

(14) Mr. A. J. Millington, Australian Delegate to Science Congress.

Strength of the staff as on 30th June 1951. The strength of the staff, permanent and temporary as on 30th June 1951, are given in Table 70 as required in the Director of Agriculture's Circular No. X. 3. 1222/48, dated 24th January 1949.

Acknowledgment.—I have great pleasure in placing on record the unstinted and loyal co-operation of my officers and subordinate staff.

COIMBATORE,
10*th August* 1951.

M. SANYASIRAJU,
Government Agricultural Chemist.

TABLE 1.—*Results of Alkalinity estimations for the soil samples from the blocks A, B, C and D collected after harvest in* 1950.

Alkaline land Reclamation Experiments, Seethambalpuram, Cauvery Mettur Project area.

Heads of analysis.	*Treatments.*									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	PER CENT.	PER CENT.	PER CENT.	PER CENT.	PER CENT.	PER CENT.	PER CENT.	PER CENT.	PER CENT.	PER CENT
				'A' Block.						
Total solids	0·120	0·280	0·061	0·015	0·073	0·035	0·055	0·030	0·020	0·112
Carbonates CO_3	nil.	nil.	nil.	nil.	nil.	nil.	nil.	nil.	nil.	nil.
Bicarbonates HCO_3 ..	0·080	0·034	0·033	0·015	0 021	0 021	0·040	0·012	0·020	0·040
Chloride Cl	0·014	0·007	0·005	0·014	0·005	0·007	0·007	0·007	0·005	0·004
pH	8·7	8 20	8·7	8·00	8·7	8·30	8·40	8·00	8·30	8·60
				'B' Block.						
Total solids	0·025	0·070	0·020	0·050	0·050	0·050	0·050	0·032	0 075	0·100
Carbonates CO_3	nil.	nil.	nil	nil.	nil.	nil.	nil.	nil.	nil.	0·001
Bicarbonates HCO_3 ..	0·015	0·024	0·021	0·027	0·035	0·018	0·021	0·030	0·024	0·055
Chloride Cl	0·005	0·007	0·010	0·018	0.004	0·005	0·005	0·005	0·009	0·007
pH	8·20	7 90	7·60	8·50	8·30	8·40	8·30	8·40	8·30	8·60
				'C' Block.						
Total solids	0·080	0·070	0·080	0·050	0·060	0·100	0·020	0·065	0·060	0·130
Carbonate CO_3	0·012	nil.	nil.	0·003	nil.	0·003	nil.	nil.	nil.	nil.
Bicarbonates HC_3	0·114	0·027	0·030	0·072	0·040	0·070	0·039	0·040	0·030	0·081
Chloride Cl	0·004	0·005	0·004	0·007	0·004	0·005	0·004	0·004	0·004	0·010
pH	8·70	8·40	8·20	8·70	8·50	8·60	8·10	8·10	8·20	8·30
				'D' Block.						
Total solids	0·120	0·010	0·130	0·075	0·070	0·050	0·050	0·105	0·055	0·120
Carbonate C_3	0·018	nil.	0·012	nil.	nil.	nil.	nil.	0·003	0·002	0·012
Bicarbonates HC_3	0·135	0·030	0·134	0·033	0·030	0·030	0·030	0·054	0·110	0·123
Chloridhs Cl	0·008	0·005	0·005	0·005	0·005	0·005	0·005	0·005	0·005	0·004
pH	8·70	8·50	8·70	8·30	8·60	8·40	8·50	8·40	8·70	8·60

Heads of analysis.	*Treatments.*									
	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
	PER CENT.	PER CENT.	PER CENT.	PER CENT.	PER CENT.	PER CENT.	PER CENT.	PER CENT.	PER CENT.	PER CENT.
					'A' Block.					
Total solids	0·075	0·150	0·090	0·110	0·035	0·075	0·090	0·170	0·050	0·040
Carbonates CO_3	nil.	0·003	nil.	nil.	nil.	nil.	nil.	nil.	nil.	nil.
Bicarbonates HCO_3	0·040	0·100	0·055	0·060	0·061	0·034	0·055	0·043	0·020	0·020
Chlorides Cl	0·007	0·014	0·007	0·010	0·005	0·007	0·007	0·014	0·020	0·010
pH	8·80	8·70	8·90	8·70	7·20	8·40	8·50	7·70	7·70	7·70
					'B' Block.					
Total solids	0·075	0·020	0·020	0·030	0·065	0·040	0·020	0·075	0·050	0·044
Carbonates CO_3	nil.	nil.	nil.	nil.	nil.	nil.	nil.	nil.	nil.	nil.
Bicarbonates HCO_3 ..	0·055	0·035	0·024	0·021	0·018	0·055	0·035	0·040	0·021	0·015
Chlorides Cl	0·009	0·007	0·005	0·007	0·014	0·009	0·007	0·014	0·010	0·014
pH	8·60	8·30	7·90	8·30	8·30	8·60	8·00	8·10	7·20	7·60
					'C' Block.					
Total solids	0·050	0·035	0·140	0·070	0·130	0·010	0·045	0·045	0·071	0·079
Carbonate CO_3	nil.	nil.	0·003	0·003	nil.	nil.	nil.	nil.	nil.	nil.
Bicarbonates HC_3	0·027	0·015	0·090	0·070	0·048	0·018	0·030	0·036	0·030	0·040
Chlorides Cl	0·004	0·004	0·004	0·004	0·004	0·004	0·004	0·004	0·004	0·004
pH	8·20	8·20	8·70	8·70	8·30	7·70	8·30	8·20	8·40	7·70
					'D' Block.					
Total solids	0·075	0·095	0·150	0·132	0·120	0·130	0·060	0·035	0·110	0·130
Carbonate CO_3	nil.	0·018	0·018	0·012	0·018	0·012	nil.	nil.	0·012	0·012
Bicarbonates HCO_3 ..	0·050	0·138	0·123	0·140	0·153	0·142	0·033	0·033	0·102	0·111
Chlorides Cl	0·004	0·005	0·008	0·008	0·004	0·008	0·004	0·04	0·005	0·808
pH	8·30	8·80	8·70	8·70	8·70	8·70	8·10	8·10	8·80	8·70

Treatments.—(1) Control; (2) Gypsum 2½ tons/acre, (3) 2 + green leaf 2,500 lb./acre; (4) 2 + green leaf 5,000 lb./acre; (5) 2 + green leaf 7,500 lb. per acre; (6) Gypsum 5 tons per acre; (7) 6 + 2,500 lb. green leaf; (8) 6 + 5,000 lb. green leaf; (9) 6 + 7,500 lb. green leaf per acre; (10) green leaf 2,500 lb./acre; (11) green leaf 5,000 lb./acre; (12) green leaf 7,500 lb./acre; (13) 10 + 1 ton lime; (14) 11 + 1 ton lime; (15) 12 + 1 ton lime; (16) Lime at 1 ton/acre; (17) Molasses 2½ tons per acre; (18) Molasses 5 tons per acre; (19) 17 + 1 ton lime; (20) 18 + 1 ton lime.

TABLE 2—*Alkaline land reclamation experiments at Pattukkottai, C.M.P. area.*

Transplanted.—4th October 1950 | Variety—Co. 25 | Treatment.—20

Harvested.—9th February 1951 | Net area—0·8 cent | Replication.—4

STRAW.

Particulars.	*Treatments.*											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1 Straw yield per plot in lb.—												
A	9·00	16·75	35·25	21·00	16·75	7·00	32·00	34·50	33·25	14·75	27·75	14·00
B	4·75	9·00	5·75	28·50	21·00	6.00	17·50	21·50	39·25	11·25	23·50	5·75
C	6.75	5·50	3·75	7·50	1·00	4·00	5·75	5·00	12·25	6·50	4·00	6·50
D	4·75	1·75	9·50	8·00	8·25	4·25	2·25	9·75	7·25	6·25	11·00	7·50
2 Total lb	25·25	33·00	54·25	65·00	47·00	21·25	57·50	70·75	92·00	38·75	66·25	33·75
3 Average lb	6·31	8·25	13·56	16·25	11·75	5·31	14·37	17·69	23·00	9·69	16·56	8·44
4 Acre yield lb	789·1	1,031·3	1,695·3	2,031·2	1,468·8	664·1	1,796·2	2,218·8	2,875·0	1,195·3	2,070·0	1,054·1
5 Yield as per cent on control.	100	130·6	214·8	257·3	186·2	84·2	227·6	281·1	364·4	151·5	262·3	133·6

Particulars.	*Treatments.*								*Standard error.*	*Standard error of the differences of means.*	*C.D. at 1 per cent.*	*Mean of average.*
	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)				
1 Straw yield per plot in lb.—												
A	13·75	16·25	14·00	20·75	13·50	16·75	12·25	20·75	..	..	..	19·50
B	17·75	21·75	21·25	15·50	26·75	19·75	20·75	27·00	..	..	..	18·21
C	5·75	4·50	7·25	3·00	3·75	4·25	2·75	7·25	..	..	..	5·31
D	10·50	6·75	7·50	6·25	6·50	8·00	2·50	5·75	..	..	..	6·71
2 Total lb	47·75	49·25	50·00	45·50	50·50	48·75	38·25	60·75	2·89	4·08	8·16	..
3 Average lb	11·94	12·31	12·50	11·37	12·63	12·19	9.56	15·19	..	..	..	..
4 Acre yield lb	1,492·0	1,539·0	1,562·5	1,421·9	1,578·2	1,523·8	1,195·3	1,898·5	360·8	..	1,020·6	..
5 Yield as per cent on control.	189·1	195·0	198·0	180·2	200·0	193·1	151·5	240·6	..	..	..	..

Conclusion.—9 8 11 4 20 7 3 17 15 14 18 13 5 16 10 19 12 2 1 6

GRAINS.

Particulars.	*Treatments.* (1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1 Grain yield per plot in lb.—												
A	3·00	6·00	13·25	6·75	5·75	1·75	9·75	11·75	10·25	4·75	8·25	4·25
B	0·16	1·50	1·50	11·00	7·00	2·50	5·00	6·00	12·25	3·75	8·00	1·50
C	2·25	1·19	0·19	2·00	0·03	0·75	1·75	0·75	2·75	2·25	1·00	2·50
D	1·00	0·37	3·25	2·25	2·25	0·75	0·50	2·25	1·50	2·25	4·25	2·25
2 Total	6·41	9·06	18·19	22·00	15·03	5·75	17·00	20·75	26·75	13·00	21·51	10·50
3 Average	1·60	2.27	4·55	5·50	3·76	1.44	4·25	5·19	6·69	3·25	5·37	2·62
4 Acre yield	203·1	281·3	570·3	687·5	468·8	179·7	531·3	648·04	867·2	406·30	671·90	328·10
5 Yield as percentage on control.	100·0	138·6	280·8	338·6	230·8	88·50	261·6	319·30	427·00	200·00	330·90	161·50

Treatments—cont.

Particulars.	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	*Standard error.*	*Standard error of the difference of means.*	*C.D. at 1 per cent level.*	*Mean of average.*
1 Grain yield per plot in lb —												
A	5·00	5·50	5·00	6·00	4·75	4·25	4·75	5·75	..	..	..	6·32
B	5·25	6·75	8·25	5·75	8·50	7·50	7·25	5·50	..	..	..	5·74
C	1·25	1·00	2·75	0·25	0·75	1·00	0·19	1·50	..	..	..	1·30
D	3·75	2·75	2·25	2·00	3·00	3·50	0·50	1·50	..	..	..	2·10
2 Total	15·25	16·00	18·25	14·00	17·00	16·25	12·69	14·25	..	..	..	..
3 Average	3·81	4·00	4·56	3·50	4·25	4·06	3·17	3·56	..	..	..	..
4 Acre yield	476·60	468·50	570·30	437·50	531·30	507·80	398·40	445·30	..	..	..	..
5 Yield as percentage on control.	234·60	230·80	280·80	215·50	261·60	250·00	196·20	219·30	..	..	..	..

Conclusion.—9 4 11 8 3 15 7 17 18 13 5 14 20 16 10 19 12 2 1 6

Treatments—

(1) Control.
(2) Gypsum at 2½ tons per acre.
(3) Gypsum at + 2,500 lb. green leaf per acre.
(4) Gypsum at + 5,000 lb. green leaf per acre.
(5) Gypsum at + 7,500 lb. green leaf per acre.
(6) Gypsum at 5 tons per acre.
(7) Gypsum at 5 tons + 2,500 lb. green leaf per acre.
(8) Gypsum at 5 tons + 5,000 lb. green leaf per acre.
(9) Gypsum at 5 tons + 7,500 lb. green leaf per acre.
(10) Green leaf at 2,500 lb. per acre.
(11) Green leaf at 5,000 lb. per acre.
(12) Green leaf at 7,500 lb. per acre.
(13) Green leaf at 2,500 lb. + 1 ton lime per acre.
(14) Green leaf at 5,000 lb. + 1 ton lime per acre.
(15) Green leaf at 7,500 lb. + 1 ton lime per acre.
(16) Lime at 1 ton per acre.
(17) Molasses at 2½ tons per acre.
(18) Molasses at 5 tons per acre.
(19) Molasses at 2½ tons per acre + 1 ton lime.
(20) Molasses at 5 tons per acre + 1 ton lime.

TABLE 3.—*pH in paddy soils.*

A. Block Wet lands, 1950–51.

Treatments.	*August.*	*September.*	*October.*	*November.*	*December.*	*January.*	*February.*	*March.*	*April.*	*May.*	*June.*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Control	8·04	7·15	7·28	7·33	7·78	8·38	7·65	7·75	8·01	8·88	8·73
Daincha	8·24	6·53	7·11	7·26	7·51	8·37	7·29	7·41	7·77	8·98	8·58
Pillipesara	8·44	6·55	7·07	7·27	7·17	8·26	7·14	7·25	7·67	8·84	8·59
Sunnhemp	8·24	6·96	6·93	7·27	7·10	8·13	7·18	7·22	7·57	8·88	8·31
Cowpea	8·29	6·88	7·08	7·26	7·03	8·31	7·07	7·16	7·70	8·82	8·55

D. Block Wet lands, 1950–51.

	September.	*October.*	*November.*	*December.*	*January.*	*February.*	*March.*	*April.*	*May.*	*June.*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Control	7·40	7·28	7·24	7·22	7·59	7·36	7·72	7·52	8·78	8·01
Daincha	7·33	7·22	7·17	7·11	7·50	7·12	7·27	7·57	8·36	8·08
Pillipesara ..	7·30	7·21	7·18	7·16	7·60	7·17	7·35	7·63	8·55	8·08
Sunnhemp ..	7·28	7·31	7·16	7·05	7·58	7·30	7·60	7·61	8·60	8·12
Cowpea	7·36	7·27	7·17	7·24	7·59	7·20	7·41	7·65	8·59	8·03

TABLE 4.—*Specific conductivity* × 10-6 *mhos in paddy soils.*

A. Block, 1950–51.

	August. (1)	*September.* (2)	*October.* (3)	*November.* (4)	*December.* (5)	*January.* (6)	*February.* (7)	*March.* (8)	*April.* (9)	*May.* (10)	*June.* (11)
Control	526·5	748·2	484·3	440·1	1115	852	153·0	178·1	159·0	124·5	184·7
Daincha	607·9	714·2	446·8	473·8	1278	1016	158·7	171·2	164·7	114·2	89·6
Pillipesara	614·2	711·1	452 8	531·5	1480	985	161·9	170·4	166·3	126·8	88·0
Sunnhemp	598·9	702·1	399·6	456·7	1316	934	160·6	169·8	166·7	118·4	102·6
Cowpea	622·4	684·1	418·8	481·9	1388	951	163·0	161·8	169·0	138·6	72·7

D. Block Wet lands, 1950–51.

	September. (1)	*October.* (2)	*November.* (3)	*December.* (4)	*January.* (5)	*February.* (6)	*March.* (7)	*April.* (8)	*May.* (9)	*June.* (10)
Control	931·8	543·3	642·3	1621·0	1586·0	193·5	223·8	210·5	178·6	342·3
Daincha	1007·7	536·5	615·1	1420·0	1581·0	202·5	226·1	214·8	122·9	96·8
Pillipesara	919·3	546·2	635·8	1669·0	1512·0	208·5	223·6	211·4	162·3	131·0
Sunnhemp	964·1	515·5	564·8	1416·0	1535·0	203·3	227·3	210·2	122·1	116·6
Cowpea	941·1	505·6	558·4	1604·0	1562·3	176·1	224·2	219·9	163·6	104 7

TABLE 5.—*Orange Hue and greyness of colour of clay samples. Lovibond units.*

Sample number of clay.	*Type of soil.*	*Orange Hue.*	*Greyness.*
25	Organic laterite	2·8	4·1
26	Do.	4·1	4·1
27	Black	0·4	1·8
28	Organic laterite	3·3	1·8
29	Alluvial	1·4	0·6
30	Do.	1·6	1·5
31	Do.	1·6	1·7
32	Do.	1·0	2·3
33	Laterite	3·5	0·3
34	Alluvial	1·7	1·0
35	Do.	1·9	2·1
36	Black	0·4	1·6

TABLE 6.—*Correlation of 2N HCl: Mono and Divalent Bases/Iron Oxide to Orange Hue.*

Sample number of clay.	*Soil type.*	*Orange Hue.*	*MD/Fe (2N. HCl)*
27	Black	0·4	1·09
36	Do.	0·4	1·72
32	Alluvial	1·0	2·72
29	Do.	1·4	0·70
31	Do.	1·6	1·24
30	Do.	1·6	0·30
34	Do.	1·7	1·39
35	Do.	1·9	1·75
25	Organic laterite	2·8	0·79
28	Do.	3·3	0·11
33	Laterite	3·5	0·44
26	Organic laterite	4·1	0·25

TABLE 7.—*Correlation of sum of Ca and Mg (2N HCl) with Orange Hue.*

Sample number of clay.	*Soil type.*	*Orange Hue.*	*Ca + Mg (2N HCl)*
27	Black	0·4	0·0746
36	Do.	0·4	0·0667
32	Alluvial	1·0	0·1461
29	Do.	1·4	0·0221
31	Do.	1·6	0·0788
30	Do.	1·6	0·0242
34	Do.	1·7	0·0696
35	Do.	1·9	0·0369
25	Organic laterite	2·8	0·0310
28	Do.	3·3	0·0096
33	Laterite	3·5	0·0318
26	Organic laterite	4·1	0·0148

TABLE 8.—*Correlation of silica-sesquioxide ratios (con. HCl) with Orange Hue.*

Sample number of clay.	*Soil type.*	*Orange Hue.*	*Si/R 203 (con. HCl.)*
27	Black	0·4	2·70
36	Do.	0·4	2·77
32	Alluvial	1·0	2·79
29	Do.	1·4	1·87
31	Do.	1·6	2·55
30	Do.	1.6	1·99
34	Do.	1·7	2·49
35	Do.	1·9	2·66
25	Organic laterite	2·8	1·11
28	Do.	3·3	1·25
33	Laterite	3·5	1·61
26	Organic laterite	4·1	1·37

TABLE 9.—*Correlation of total exchangeable bases (TEB) with Orange Hue.*

Sample number of clay.	*Soil type.*	*Orange Hue.*	*Total exchangeable bases (m. e. percentage.*
27	Black	0·4	76
36	Do.	0·4	63
32	Alluvial	1·0	58
29	Do.	1·4	37
31	Do.	1·6	62
30	Do.	1·6	22
34	Do.	1·7	61
35	Do.	1·9	56
25	Organic laterite	2·8	37
28	Do.	3·3	8
33	Laterite	3·5	45
26	Organic laterite	4·1	8

TABLE 10.—*Correlation of greyness of colour with organic matter.*

Sample number of clay.	*Soil type.*	*Greyness or colour.*	*Organic matter percentage.*
33	Laterite	0·3	0·7
29	Alluvial	0·6	2·0
34	Do	1·0	0·5
30	Do.	1·5	2·6
36	Black	1·6	0·3
31	Alluvial	1·7	0·5
27	Black	1·8	1·0
28	Organic laterite	1·8	5·1
35	Alluvial	2·1	0·4
32	do	2·3	0·7
25	Organic laterite	4·1	10·7
26	Do.	4·1	6·2

TABLE 11.—*Showing the salt content of plots under different systems of irrigation in Block III—Total solids—Percentage on air dry basis.*

Treatments.	First foot.	Second foot.	Third foot.	average of three feet.
1 Ryots' method	0·0740	0·0990	0·1050	0·0927
2 2″ once in 15 days ..	0·0910	0·1080	0·1170	0·1053
3 3″ Do. ..	0·0930	0·1000	0·1150	0 1027
4 3″ once in 30 days ..	0·0800	0·0960	0·1200	0·0987
5 No irrigation	0·0920	0·1140	0·1820	0·1293

TABLE 12.—*Showing the average salt content of the top three feet layer of soils under different systems of irrigation for different years—Total solids—Percentage on air dry basis.*

	1947–48.	1948–49.	1949–50.	1950–51.
1 Ryots' method	0·0917	0·0945	0·0993	0·0927
2 2″ once in 15 days ..	0·1083	0·1053	0·1057	0·1053
3 3″ Do. ..	0 1048	0·1047	0·1048	0·1027
4 3″ once in 30 days ..	0·1210	0·0967	0·0952	0·0987
5 No irrigation	0·1127	0·1289	0·1355	0·1293

TABLE 13.—*Showing total (water soluble) salts in wet lands—Total solids—Percentage on air dry basis.*

	First foot.	Second foot.	Third foot.	Average of three feet.
1. Single crop area—				
(i) Pre-irrigation (1939)	0·1650	0·7900	0·9460	0·6337
(ii) Post-irrigation (1950) ..	0·0950	0·1283	0·1428	0·1220
2. Sugarcane paddy rotation—				
(i) Pre-irrigation (1939)	0·1060	0·5860	0·4620	0·3847
(ii) Post-irrigation (1950) ..	0·0900	0·1243	0·2500	0·1548

TABLE 14.—*Showing total water soluble salts in Block VIII—Garden land—Total solids—Percentage on air dry basis.*

	First foot.	Second foot.	Third foot.	Average of three feet.	Average of three feet (1949–50).
1 Cotton	0·0858	0·0982	0·1208	0·1016	0·1073
2 Wheat	0·0804	0·1020	0·1232	0·1019	0·1079
3 Jonna	0·0758	0·1090	0·1203	0·1017	0·1114
4 Groundnut	0·0770	0·1010	0·1200	0·0993	0·1123

TABLE 15.—*Showing exchangeable bases and degree of alkalization in pre-and post-irrigation soils of Block VIII—Garden land—Percentage on dry basis.*

Particulars.	Pre-irrigation.			Post-irrigation.		
	First foot.	*Second foot.*	*Third foot.*	*First foot.*	*Second foot.*	*Third foot.*
1 Total exchangeable bases (m.e. percentage).	60·3	62·4	62·6	54·1	55·1	58·1
2 Exchangeable sodium (m.e. percentage).	7·12	8·25	9·06	5·70	8·10	8·9)
3 Exchangeable potassium (m.e. per centage).	0·63	0·65	0·64	0·57	0 66	0·81
4 Degree of alkalization $\frac{Na + K}{Total} \times 100$.	12·85	14·27	15·50	11·59	15·66	16·66

TABLE 16.—*Showing exchangeable bases and degree of alkalization in pre-and post-irrigation soils of Block V—Wet lands (on dry basis).*

	Single-crop area.		Sugarcane-paddy rotation.	
	Pre-irrigation. 0–30″ soil.	*Post-irrigation. 0–36″ average.*	*Pre-irrigation. 0–30″ soil.*	*Post-irrigation. 0–36″ average.*
1 Total exchangeable bases (m.e. percentage)	60·24	56·80	59·20	55·75
2 Exchangeable sodium (m.e. percentage).	8·93	6·85	8·57	6·81
3 Exchangeable potassium (m.e. percentage).	0·77	0·71	0·88	0·69
4 Degree of alkalization ..	16·10	13·29	15·90	13·34

TABLE 17.—*Showing the results of analysis of irrigation and drainage waters from Block V—Wet lands (parts per 100,000).*

	Irrigation water.	*Drainage water.*
Radicals—		
Carbonates	..	0·3
Bicarbonates	14·64	18·91
Chlorides	3·22	5·46
Sulphates	1·20	2·06
Calcium	2·80	4·60
Magnesium	..	..
Calculated salts—		
Calcium bicarbonate	11·34	18·63
Sodium bicarbonate	8·42	6·73
Sodium carbonate	..	0·53
Sodium chloride	5·31	9·01
Sodium sulphate	1·83	3·04
Total salts ..	26·90	37·94
Total solids ..	18·8	28·6

TABLE 18—*Detailed results of analysis of soils drawn from Block III for the year* 1950-51.

	Plot i-A.					
	0′–1′	1′–2′	2′–3′	3′–4′	4′–5′	5′–5½′
Carbonates	0·0030	0·0030	..	0·0030	..	..
Bicarbonate	0·0610	0·0824	0·0793	0·0641	0 0366	0·0488
Chloride	0·0053	0·0053	0·0214	0·0142	0·0178	0·0320
Sulphate	Nil	Trace	0·0247	0·0823	0·6027	0·3126
Calcium	..	0·0070	0·0070	0·0080	0·0610	0·0230
Magnesium	..	..	..	0·0044	0·0127	0·0057
Calculated salts—						
$Ca(HCO_3)_2$	..	0·0283	0·0283	0·0324	0·0487	0·0648
Magnesium bicarbonate	..	..	..	..	..	..
Sodium bicarbonate	0·0840	0·0841	0·0799	0·0547	..	..
Sodium carbonate	0·0053	0·0053	..	0·0053	..	..
Calcium sulphate	..	..	..	..	0·1438	0·0238
Magnesium sulphate	..	..	..	..	0·0629	0·0282
Sodium sulphate	..	..	0·0365	0·1217	0·6769	0·4042
Sodium chloride	0 0087	0·0087	0·0353	0·0234	0·0293	0·0522
Total salts	0·0980	0·1211	0·1800	0·2375	0·9616	0·5732
Total solids	0 0920	0·1141	0 1820	0·2320	0·9460	0·6000

	Plot ii-B.				
	0′–1′	1′–2′	2′–3′	3′–4′	4′–4′9″
Carbonates	0·0030	0·0060	0·0090	0·0030	..
Bicarbonate	0·0427	0·0641	0·0702	0·0671	0·0305
Chloride	0·0066	0·0049	0·0043	0·0066	0·0080
Sulphate	..	..	..	..	0·6828
Calcium	0·0030	0·0030	0·0030	0·0030	0·1580
Magnesium	..	..	..	..	0·0199
Calculated salts—					
$Ca(HCO_3)_2$	0·0122	0·0122	0 0122	0·0122	0·0420
Magnesium bicarbonate	..	..	..	..	..
Sodium bicarbonate	0·0461	0 0756	0·0840	0·0798	..
Sodium carbonate	0·0053	0·0106	0·0159	0 0053	..
Calcium sulphate	..	..	..	..	0·4980
Magnesium sulphate	..	..	..	..	0·0983
Sodium sulphate	..	..	..	..	0 3741
Sodium chloride	0·0109	0·0081	0·0071	0·0109	0·1318
Total salts	0·0745	0·1065	0·1192	0·1082	1·1442
Total solids	0·0740	0·0990	0·1050	0·1072	1·0720

	Plot ii.					
	0′–1′	1′–2′	2′–3′	3′–4′	4′–5′	5′–5½′
Carbonates	0·0060	..	..	..	..	..
Bicarbonate	0·0511	0·0854	0·0854	0·0854	0·0336	0·0366
Chloride	0·0058	0·0107	0·0066	0·0056	0·0071	0·0071
Sulphate	..	..	..	0·0223	0·9230	0·6428
Calcium	0·0035	0·0020	0·0030	0·0030	0·1750	0·0900
Magnesium	..	..	..	..	0·0218	0·0183
Calculated salts—						
Ca $(HCO_3)_2$	0·0142	0·0081	0·0122	0·0122	0·0446	0·0486
Magnesium bicarbonate ..	..	..	..	..	..	..
Sodium bicarbonate ..	0·0556	0·1092	0·1050	0·1050	..	..
Sodium carbonate	0·0106	..	..	..	..	..
Calcium sulphate	..	..	..	..	0·5575	0·2652
Magnesium sulphate ..	..	..	..	..	0·1080	0·0908
Sodium sulphate	..	..	..	0.0329	0·6705	0·4508
Sodium chloride	0·0096	0·0176	0·0082	0·0092	0·0117	0·0117
Total salts ..	0·0900	0·1249	0·1381	0·1593	1.3923	0·8671
Total solids ..	0·0910	0·1080	0·1170	0·1400	1·4400	0·9900

	Plot ii-D.						
	0′–1′	1′–2′	2′–3′	3′–4′	4′–5′	5′–5½′	5½′–6′
Carbonate	..	0·0030	..	0·0060	..	..	0·0030
Bicarbonate	0·0610	0·0793	0·0793	0·0853	0.0761	0·0732	0·0641
Chloride	0·0089	0·0056	0·0044	0·0050	0·2310	0·0089	0·0071
Sulphate	..	..	..	0·0145	0·0321	0·0671	0·0995
Calcium	0·0020	..	..	.	0·0130	0·0040	0·0060
Magnesium	..	..	..	..	..	..	..
Calculated salts—							
Calcium bicarbonate ..	0·0081	..	..	..	0 0526	0·0162	0·0243
Magnesium bicarbonate ..	..	..	..	..	..	..	..
Sodium bicarbonate ..	0·0756	0·1092	0·1092	0·1174	0·0379	0·0840	0·0620
Sodium carbonate	..	0·0053	..	0·0106	..	..	0·0053
Calcium sulphate	..	..	..	..	..	..	..
Magnesium sulphate ..	..	..	..	..	..	..	..
Sodium sulphate	..	..	..	0·0219	0·0475	0·0992	0·1472
Sodium chloride	0·0147	0·0092	0 0021	0.0082	0·3807	0 0147	0·0117
Total salts ..	0·0984	0·1237	0·1164	0·1581	0·5187	0·2141	0·2505
Total solids ..	0·0930	0·1000	0·1150	0·1350	0·5120	0·1980	0·2270

	Plot iiiE.					
	0′–1′	1′–2′	2′–3′	3′–4′	4′–4½′	4½″–5′
Carbonates	0·0060	0.0090	0·0030	..	0.0090	0·0090
Bicarbonates	0·0427	0·0641	0·0885	0 0793	0 0732	0·0671
Chloride	0·0056	0·0050	0·0071	0·0085	0·0056	0·0050
Sulphate	..	..	..	0·0107	0·0152	0·0202
Calcium	..	..	..	..	..	..
Magnesium	..	..	..	..	..	..
Calculated salts—						
Calcium bicarbonate ..	..	..	..	..	..	..
Magnesium bicarbonate ..	..	..	..	..	..	..
Sodium bicarbonate ..	0·0588	0·0883	0·1219	0·1092	0·1008	0·0924
Sodium carbonate	0·0106	0·0159	0·0053	..	0·0159	0·0159
Calcium sulphate	..	..	..	..	..	..
Magnesium sulphate ..	..	..	..	..	..	..
Sodium sulphate	..	..	..	0·0158	0·0225	0·0298
Sodium chloride	0·0092	0·0082	0.0117	0·0140	0·0092	0·0023
Total salts ..	0·0720	0·1124	0·1384	0·1390	0.1484	0·1404
Total solids ..	0·0800	0·0960	0·1200	0·1280	0·1370	0·1330

TABLE 19.—*Results of analysis for total solids of soils from wet lands for the year* 1950–51.

Plot number, etc.	*Total solids.*		
	0–1′	1–2′	2–3′
(1)	(2)	(3)	(4)
Plot 1 Double crop	0·0870	0·0940	0·1250
Plot 2 do.	0·0700	0.1070	0·1250
Plot 4 Sugarcane paddy	0·0910	0·1300	0·1420
Plot 5 do.	0·0880	0·1120	0·1280
Plot 7 Single crop	0·0940	0·1220	0·1600
Plot 8 do.	0·0970	0·1220	0·4930
Plot 11 Double crop	0·0700	0·1020	0·1100
Plot 12 do.	0·0990	0·1300	0·1330
Plot 14 Sugarcane	0·1090	0·1480	0·1550
Plot 15 do.	0·0920	0·1330	0·1460
Plot 17 Single crop	0·0900	0·1240	0·1520
Plot 18 do.	0·0790	0·1300	0·1990

TABLE 20.—*Detailed results of analysis of Block VIII soils* (1950–51) (*percentage on air dry basis*).

		Cotton.			*Wheat.*			*Jonna.*			*Groundnut plus Red gram.*		
HCO_3—		0′–1′	1′–2′	2′–3′	0″–1′	1′–2′	2′–3′	0′–1′	1′–2′	2′–3′	0′–1′	1′–2′	2′–3′
1 Replication	.. ..	0·0610	0·0641	0·0761	0·0488	0·0671	0·0793	0·0641	0·0885	0·0885	0·0641	0·0732	0·0671
2 Do.	.. ..	0·0549	0·0732	0·0732	0·0549	0·0732	0·0915	0·0549	0·0671	0·0793	0·0580	0·0671	0·0824
3 Do.	.. ..	0·0671	0·0732	0·0793	0·0549	0·0702	0·0793	0·0488	0·0732	0·0671	0·0549	0·0763	0·0793
4 Do.	.. ..	0·0610	0·0732	0·0854	0·0610	0·0793	0·0854	0·0610	0·0732	0·0854	0·0549	0·0702	0·0793
5 Do.	.. ..	0·0610	0·0671	0·0702	0·0549	0·0732	0·0793	0·0610	0·0671	0·0793	0·0048	0·0549	0·0732
6 Do.	.. ..	0·0610	0·07 3	0·0854	0·0549	0·0793	0·0915	0·0610	0·0702	0·0824	0·0671	0·0732	0·0915
Total	..	0·3660	0·4301	0·4696	0·3294	0·4423	0·5063	0·3498	0·4393	0·4820	0·3017	0 4149	0·4728
Average	..	0·0610	0·0717	0·0783	0·0549	0·0737	0·0844	0·0583	0·0732	0·0803	0·0503	0·0692	0·0788
Cl—													
1 Replication	.. ..	0 0049	0·0043	0·0043	0·0057	0·0043	0·0049	0·0043	0·0049	0·0057	0·0029	0·0049	0·0078
2 Do.	.. ..	0·0029	0·0036	0·0049	0·0036	0·0043	0·0057	0·0043	0·0049	0·0057	0·0022	0·0049	0·0036
3 Do.	.. ..	0·0050	0·0036	0·0057	0·0064	0·0050	0·0071	0·0050	0·0050	0·0071	0·0043	0·0059	0·0071
4 Do.	.. ..	0·0284	0·0036	0·0057	0·0142	0·0057	0·0036	0·0057	0·0057	0·0057	0·0050	0·0064	0·0057
5 Do.	.. ..	0·0071	0·0064	0·0078	0·0050	0·0050	0·0071	0·0057	0·0057	0·0053	0·0029	..	0·0085
6 Do.	.. ..	0·0050	0·0050	0·0057	0·0089	0·0053	0·0071	0·0036	0·0156	0·0050	0·0036	0·0053	0·0071
Total	..	0·0249	0·0265	0·0341	0·0438	0·0296	0·0355	0·0286	0·0418	0·0295	0·0209	0·0274	0·0398
Average	..	0·0050	0·0041	0·0057	0·0073	0·0050	0·0059	0·0048	0·0070	0·0050	0·0035	0·0055	0·0066

Total solids—													
1 Replication	..	..	0·0850	0·0930	0·1100	0·0750	0·0900	0·1130	0·0790	0·1060	0·1240	0·0710	0·1080	0·1250
2 Do.	..	..	0·0810	0·0880	0·1030	0·0700	0·0980	0·1270	0·0730	0·1030	0·1230	0·0750	0·0920	0·0990
3 Do.	..	..	0·0810	0·0950	0·1060	0·0880	0·1060	0·1310	0·0580	0·1000	0·1110	0·0760	0·0970	0·1030
4 Do.	..	..	..	0·1030	0·1330	0·095	0·1100	0·1200	0·0870	0·1200	0·1180	0·0740	0·1020	0·1140
5 Do.	..	..	..	0·1090	0·1520	0·0720	0·1080	0·1370	0·0860	0·1130	0·1270	0·0800	..	0·1560
6 Do.	..	..	0·0960	0·1010	0·1210	0·0830	0·1000	0·1110	0·0720	0·1120	0·1190	0·0860	0·1060	0·1230
Total	..		0·3430	0·5890	0·7250	0·4830	0·6120	0·7390	0·4550	0·6540	0·7220	0·4620	0·5050	0·7200
Average	..		0·0858	0·0982	0·1208	0·0804	0·1020	0·1232	0·0758	0·1090	0·1203	0·0770	0·1010	0·1200
Carbonates—														
1 Replication	..	..	0·0030	0·0060	0·0030	0·0030	0·0030	0·0030	..	..	0·0030	..	0·0030	0·0060
2 Do.	..	..	..	0·0030	0·0030	0·0030	0·0030	0·0030	..	0·0060	0·0060	..	0·0030	0·0030
3 Do.	..	..	..	0·0030	0·0030	0·0030	0·0030	0·0060	..	..	0·0060	Traces	0·0030	0·0060
4 Do.	..	..	..	0·0030	..	..	..	..	..	0·0060	0·0060	..	0·0030	0·0030
5 Do.	..	..	..	0·0090	0·0090	..	..	..	..	Traces	Traces	0·0030	..	0·0060
6 Do.	..	..	..	..	..	..	0 0060	0·0060	..	0·0030	0·0030	..	0·0030	..
Total	..		0·0030	0·0240	0·0180	0·0090	0·0150	0·0180	..	0·0150	0 0240	0·0030	0·015	0·0240
Average	..		0·0005	0·0040	0·0030	0·0015	0·0025	0·0030	..	0·0025	0·0040	0·0005	0·0025	0·0040

Showing the physico-chemical properties of garden land soils of Block VIII of Agricultural Research Station, Siruguppa.

Heads of analysis.	Cotton.			Wheat.			Groundnut.			Jonna.		
	First foot.	Second foot.	Third foot.	First foot.	Second foot.	Third foot.	First foot.	Second foot;	Third foot.	First foot.	Second foot.	Third foot.
1 pH	8·0	8·72	8·63	8.46	8·51	8·63	8·36	8·88	8.86	8·19	8·63	8·96
2 Mechanical composition—												
Fine fraction	72·36	74·23	78·45	74·71	76·54	79·05	74·50	75·80	78·50	75·25	75·98	79·34
Coarse fraction	21·15	21·60	19·35	21·72	18·59	16·55	22·03	20·33	16·96	20·36	20·01	16·67
3 Exchangeable bases—												
(i) Total	53·7	53·9	57·2	53·1	55·2	57·8	55·3	55·7	59·99	54·2	55·40	57·4
(ii) Exchangeable sodium	5·89	8·21	9·03	6·03	8·15	9·17	5·34	8·06	8·32	5·54	7·94	8·90
(iii) Exchangeable potassium	0·51	0·62	0·78	0·58	0·70	0·82	0 62	0·74	0·86	0·55	0·56	0·79
(iv) Degree of alkalization	11·92	16·39	17·15	12·45	16·03	17·29	10·77	15·80	15·30	11·24	14·33	16·89
4 Total nitrogen	0·046	0·034	0·032	0·049	0·034	0·030	0·049	0·0210	0·027	0·041	0·032	0·029
5 Organic matter	0·498	0·436	0·362	0·634	0·412	0·399	0·583	0·361	0·338	0·500	0·388	0·347
6 Available P 265	0·015	0·013	0·013	0·019	0·013	0·011	0·0134	0·0128	0.011	0·014	0·012	0·014

Replications of each treatment mixed and sub-sampled.

TABLE 21.—*Detailed results of analysis of pre and post irrigation soils of Block V for exchangeable bases and degree of alkalization.*

Plot.	Sugarcane paddy rotation area.								Single crop area.			
	Pre-irrigation.				Post irrigation.				0·30″ soil Preirrigation.		0·36″ average Post irrigation.	
	4	5	14	15	4	5	14	15	7	8	7	8
		0·3″				0·36″	average		0·30″	0·36″		
1 Total exchangeable bases m.e. percentage	60·09	59·85	60·77	60·24	57·74	53·80	57·56	53·90	60·75	57·65	57·80	55·80
2 Exchangeable sodium m.e. percentage	9·12	8·77	8·58	9·26	6·68	6·82	6·66	7·07	8·39	8·75	6·46	7·24
3 Exchangeable potassium m.e. percentage	0·87	0·69	0·72	0.78	0·71	0·72	0·66	0·68	0·71	0·95	0·66	0·75
Total of Na + K												
4 Degree of alkalization Na + K × 100	9·99	9·46	9·30	10·04	7·39	7·54	7·32	7·75	9·10	9·70	7·12	7·99

TABLE 22.—*Showing the physico-chemical properties of pre-irrigation soils of Block VIII Agricultural Research Station, Siruguppa (percentage on dry basis).*

	Profile A.			*Profile B.*			*Average.*		
	First foot.	*Second foot.*	*Third foot.*	*First foot.*	*Second foot.*	*Third foot.*	*First foot.*	*Second foot.*	*Third foot.*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Fine fraction	72·24	73·82	77·03	74.5	75·86	75·65	73·37	74·84	76·34
Coarse fraction	21·42	20·04	17·77	20·6	19·39	18·49	21·01	19·72	18·13
Total exchangeable bases m.e. ..	59·23	62·12	62·38	61·37	62·61	62·80	60·3	62·4	62·60
Exchangeable sodium m.e. ..	8·20	8·90	9·91	6·03	7·59	8·21	7·12	8·25	9·06
Exchangeable Potassium	0·62	0·66	0·63	0·64	0·64	0·64	0.63	0·65	0·64
Degree of alkalization	14·89	15·39	16·9	10·86	13·14	14·09	12·85	14·27	15·5
Total nitrogen	0·042	0·074	0·064	0·044	0·068	·055	·043	0·071	0·059
Organic matter	0·388	0·642	0·592	0·440	0·567	·557	·414	0·605	0·575
Available P_2O_5	0·010	0·011	0·011	0·010	0·010	0·012	·01	0·011	0·012

TABLE 23.—*Comparison of pre and post-irrigation soils of Block, VIII, Agricultural Research Station, Siruguppa (percentage on dry basis).*

	Pre-irrigation (average values).			*Post-irrigation (average values).*		
	First foot.	*Second foot.*	*Third foot.*	*First foot.*	*Second foot.*	*Third foot.*
Fine fraction ..	73·37	74·84	76·34	74·21	75·64	78·84
Coarse fraction ..	21·01	19·72	18·13	21.32	20·13	17·38
Total exchangeable bases m.e.	60·3	62·4	62·6	54·1	55·05	58·1
Exchangeable Na m.e.	7·12	8·25	9·06	5·7	8·1	8·9
Exchangeable K m.e.	0·63	0·65	0·64	0·57	0·66	0·81
Degree of alkalization.	12·85	14·27	15·5	11·59	15·66	16·66
Total N	0·043	0·071	0·059	0·041	0·032	0.030
Organic matter ..	0·414	0·605	0·575	0·554	0 399	0·382
Avail P_2O_5 ..	0·010	0·011	0·011	0·015	0·013	0·012
Pre-irrigation values				Averages of 2 type profiles.		
Post-irrigation values				Averages for the 4 treatments 1 replication mixed and sub-sampled.		

TABLE 24.—*P.C.H. Experiment*, 1949–50.

Treatments.	*Carbon* PERCENTAGE.	*Nitrogen* PERCENTAGE.	*C/N ratio.*
Original soil ..	0·251	0·031	7·8
I. No manure—Uncropped	0·231	0·030	7.81
II. „ Cropped	0·233	0·030	7·77
III. Green manure 5,000 lb. per acre —Uncropped.	0·248	0·029	8·79
IV. Green manure 5,000 lb. per acre —Cropped.	0·261	0·029	8·91
V. Ammonium sulphate N=that in IV—Uncropped.	0·251	0·030	8·40
VI. Ammonium sulphate N=that in IV—Cropped.	0·237	0·030	7·88
VII. Green manure 10,000 lb. per acre —Cropped.	0·262	0·034	8·00
VIII. Ammonium sulphate N=that in VII—Cropped.	0·243	0·033	7·84
IX. Combination of green manure plus ammonium sulphate Treatment IV plus Treatment VI—Cropped	0·242	0·033	7·44

TABLE 25.—*Yield Data Potato Experiment—Agricultural Research Station, Nanjanad*, 1950–51.

Sown—31st March 1950. Harvested—Third of week September 1950.

Pounds per plot.

Replications.	*I* 2N–5P–3K		*II* 2N–3P–3K		*III* 2N–1P–3K		*IV* 2N–0P–3K		*V* 1N–5P–3K		*VI* 1N–3P–3K		*VII* 1N–1P–3K		*VIII* 1N–0P–3K	
	No lime.	*Lime.*	*No lime.*	*Lime.*	*No lime.*	*Lime.*	*No lime.*	*Lime.*	*No lime.*	*Lime.*	*No lime.*	*Lime.*	*No lime.*	*Lime.*	*No lime.*	*Lime.*
1	38	24	33	49	42	44	15	15	27	46	43	50	28	40	38	29
2	46	51	28	42	41	36	32	20	37	45	41	39	16	37	23	38
3	75	49	55	66	63	56	28	24	30	43	31	71	32	50	41	48
4	53	43	43	58	62	38	58	23	63	54	48	58	48	37	46	53
5	51	57	42	38	49	43	24	26	47	49	45	37	28	37	21	23
6	41	40	42	34	24	34	30	37	48	42	39	49	38	39	23	37
7	53	28	27	24	16	34	16	15	21	42	37	52	43	21	17	19
8	24	54	25	39	30	44	17	16	30	23	17	21	25	35	13	23
Average per plot.	47·6	49·3	36·8	43·8	40·9	41·1	27·5	22·0	37·9	43	37·3	46·1	31·8	35·8	27·8	33·8
Average per acre.	7,454	8,547	6,273	7,874	7,137	6,908	6,227	4,364	8,091	7,454	6,594	7,591	5,773	6,728	4,773	6,864

TABLE 26.—*Experiment on reduction of manurial bill for Potatoes at the Agricultural Research Station, Nanjanad, 1950–51.*

1 Field Nos. 14-A and plots 1, 2 and 3 in field No. 1 series II.
2 System of replication—Randomized blocks—8 × 8 × 2.
3 Area of each plot—0·55 cents nett.
4 Soil—Laterite.
5 Treatments—

A. Lime series.

	N	P	K
	LB.	LB.	LB.
1N 0P 3K	40	0	100
1N 1P 3K	40	40	100
1N 3P 3K	40	120	100
1N 5P 3K	40	200	100
2N 0P 3K	80	0	100
2N 1P 3K	80	40	100
2N 3P 3K	80	120	100
2N 5P 3K	80	200	100

B. No lime series.

	N	P	K
	LB.	LB.	LB.
1N 0P 3K	40	0	100
1N 1P 3K	40	40	100
1N 3P 3K	40	120	100
1N 5P 3K	40	200	100
2N 0P 3K	80	0	100
2N 1P 3K	80	40	100
2N 3P 3K	80	120	100
2N 5P 3K	80	200	100

6 Basal dressing of cattle manure at 5 tons.
7 Manuring.
8 Date of planting—31st March 1950.
9 Time of harvesting—Third week of September.
10 Variety—Great Scot.

(*a*) *Lime* vs. *No lime.*

Particulars.	*Mean yield of potatoes.*		*General mean.*	*Significant or not.*
	Lime.	*No lime.*		
(1)	(2)	(3)	(4)	(5)
In pounds per acre	7,069	6,554	6,811	Not.
As percentage on general mean ..	100·4	96·2	100	..
As percentage on control	107·8	100	..	..

Conclusion.—Not significant.

(*b*) *Nitrogen* (*Single* vs. *Double dose*).

Particulars.	*Mean yield of potatoes in lb. per acre.*			*Significant or not.*
	Nitrogen 40 lb.	*Nitrogen 80 lb.*	*General mean.*	
(1)	(2)	(3)	(4)	(5)
In pounds per acre	6,736	6,887	6,811	Not.
As percentage on general mean ..	98·91	101·1	100	..
As percentage over 40 lb. N. ..	100	102·2	..	..

Conclusion—Not significant.

(c) *Phosphoric acid (varying levels).*

Particulars.	*Mean yield of potatoes.* 0	40	120	200	*General mean.*	*S.E. of treatment.*	*Significant or not.*	*Critical difference.*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	LB.	LB.	LB.	LB.				
In pounds per acre ..	5,224	7,119	7,784	8,093	6,811	304	Yes	852·3
Percentage on general mean.	76·7	104·5	114·3	118·8	100	..	..	..
Percentage on O.P.	100	136·2	149·0	154·9	..	..	..	..

Conclusion—5P 3P 1P 0P

Interactions.

	Per acre. LB.
A. 2N + 5P + 3K	8,260
B. 2N + 3P + 3K	7,330
C. 2N + 1P + 3K	7,454
D. 2N + 0P + 3K	4,500
E. 1N + 5P + 3K	7,352
F. 1N + 3P + 3K	7,703
G. 1N + 1P + 3K	6,295
H. 1N + 0P + 3K	5,591

Conclusions.—A F C E B G H D.

TABLE 27.—*Economics of yield per acre—Potato Experiment, Agricultural Research Station, Nanjanad.*

Composition of manure.	*Limed series.* *Cost of manure.* RS. A. P.	*Cultivation and other charges.* RS. A. P.	*Total cultivation charges.* RS. A. P.	*Return from yield.* RS. A. P.	*Profit.* RS. A. P.
		Double dose of nitrogen.			
2N + 5P + 3K ..	356 10 9	706 9 5	1,063 4 2	921 14 4	—141 5 8
2N + 3P + 3K ..	305 14 10	706 9 5	1,012 8 3	912 1 7	— 52 3 5
2N + 1P + 3K ..	253 11 5	706 9 5	960 4 10	918 1 6	— 42 3 4
2N + 0P + 3K ..	227 10 11	706 9 5	934 4 4	435 1 8	—499 2 8
		Single dose of nitrogen.			
1N + 5P + 3K ..	330 14 9	706 9 5	1,037 8 2	925 1 2	—112 7 0
1N + 3P + 3K ..	280 2 10	706 9 5	986 12 3	1,008 12 10	+ 22 0 7
1N + 1P + 3K ..	227 14 7	706 9 5	934 8 0	782 11 2	—151 12 10
1N + 0P + 3K ..	201 14 11	706 9 5	908 8 4	761 3 2	—147 5 2

Composition of manure.	*Unlimed series.* *Cost of manure.*			*Cultivation and other charges.*			*Total cultivation charges.*			*Return from yield.*			*Profit.*		
	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.
Double dose of nitrogen.															
2N + 5P + 3K ..	250	2	7	706	9	5	956	12	0	1,060	9	7	+103	13	7
2N + 3P + 3K ..	199	6	8	706	9	5	906	0	1	770	14	5	—135	1	8
2N + 1P + 3K ..	147	3	3	706	9	5	853	12	8	911	8	2	+ 57	11	6
2N + 0P + 3K ..	121	2	9	706	9	5	827	12	2	541	14	4	—285	13	10
Single dose of nitrogen.															
1N + 5P + 3K ..	224	6	7	706	9	5	931	0	0	741	12	9	—189	3	3
1N + 3P + 3K ..	173	10	8	706	9	5	850	4	1	799	1	7	— 81	2	6
1N + 1P + 3K ..	121	6	5	706	9	5	827	15	10	675	1	7	—152	14	3
1N + 0P + 3K ..	95	6	9	706	9	5	802	0	2	549	8	5	— 25	7	9

TABLE 28.—*Cholam Co.* 6 (*AS* 7561) *sown on* 13*th March* 1951.

	Control.	4 *hrs.*	8 *hrs.*	12 *hrs.*	16 *hrs.*	20 *hrs.*	24 *hrs.*	*D.W.*
Germination percentage.	100·0	93·1	90·9	84·5	39·4	54·5	78·7	81·8
Moisture percentage.	8·36	10·85	9·60	9·96	10·49	13·38	10·27	25·97
P205 percentage ..	0·98	1·22	1·41	1·37	0·82	0·92	1·14	1·07
Height Cm. on 21st March 1951.	14·6	8·6	10·3	11·7	11·3	9·6	13·6	11·5
Height Cm. on 31st March 1951.	44·4	44·5	44·7	46·7	50·6	44·8	45·6	43·2
Height Cm. on 10th April 1951.	52·4	55·2	55·0	57·7	59·5	52·5	51·2	50·3
Height Cm. on 20th April 1951.	62·9	64·0	62·6	65·6	76·4	67·4	67·8	61·8

From the data it is seen that a phosphate balance varies with the hours of soaking. The volume/weight ratio is 1 to 3 for soaking.

TABLE 29.—*Yield of cholam.*

F. No. 68.	*No manure.*	*Nightsoil compost.*	*Farmyard manure.*	*Significance.*
Yield of grain in lb. per acre ..	686·8	640·0	601·6	No.
Percentage on control	100	93·2	87·6	..
Conclusion—A B C.				
F. No. 74.				
Yield of grain in lb. per acre ..	592·0	556·8	558·4	No.
Percentage on control	100	94·0	94·3	..
Conclusion—A C B.				

TABLE 30.—*Yield of paddy.*

	Control.	*Nightsoil compost.*	*Farmyard manure.*	*Significance.*
I Series—				
Grain yield in lb. per acre ..	2,260	2,600	2,512	No.
Percentage on control ..	100	115	111	..
Straw yield in lb. per acre ..	2,840	4,886	4,120	No.
Percentage on control ..	100	172	145	..

Conclusion—B C A.

(*Grain and straw.*)

III Series—				
Grain yield in lb. per acre ..	2,370	2,330	2,380	No.
Percentage on control ..	100	100	100	..
Straw yield in lb. per acre ..	3,860	2,980	3,880	No.
Percentage on control ..	100	77·2	100·1	..

Conclusion—Grain B C A.

Straw C A B.

TABLE 31.—*Yield of sugarcane.*

	No manure.	*Nightsoil compost.*	*Farmyard manure.*
Acre yield of sugarcane in tons	36·22	46·26	42·80
Percentage on control	100	127·5	117·9

TABLE 32.—*Yield of plantains.*

	No manure.	*Nightsoil compost.*	*Farmyard manure.*
Number of bunches	29	50	79
Weight in lb.	595	968	1,870
Average weight in lb.	20·5	19·4	23·7

TABLE 33.—*Yield of paddy.*

	No manure.	*Nightsoil compost.*	*Farmyard manure.*	*Significance.*
	A.	*B.*	*C.*	
Acre yield of grain in lb. ..	1,284	1,407	1,588	Yes.
Percentage on control	100	109·7	123·7	..
Acre yield of straw in lb. ..	2,022	2,205	2,414	Yes.
Percentage on control	100	109·0	119·3	..

Conclusion—Grain C B A.

Straw C B A.

TABLE 34.—*Yield of paddy.*

	No manure.	*Nightsoil compost.*	*Farmyard manure.*	*Significance.*
	A.	*B.*	*C.*	
Acre yield of grain in lb. ..	984	1,037	1,134	Yes.
Percentage on control	100	105·4	115·3	
Acre yield of straw in lb. ..	1,170	1,430	1,450	Yes.
Percentage on control	100	122·2	123·9	

Conclusion—Grain C B A.

Straw C B A.

TABLE 35.

	No manure.	*Farmyard manure.*	*Nightsoil compost.*	*Significance.*
	A.	*B.*	*C.*	
Yield of chillies in lb. per acre ..	547	787	1,122	Yes.
Percentage on control	100	137	195	

Conclusion—C B A.

Yield of variga in lb. per acre ..	350	500	430	No.
Percentage on control	100	143	123	

Conclusion—B C A.

TABLE 36.—*Yield of paddy.*

	No manure.	*Nightsoil compost.*	*Farmyard manure.*	*Significance.*
	A.	*B.*	*C.*	
Acre yield of grain in lb.	1,883	2,239	2,043	No.
Percentage on control ..	100	118·3	108·0	

Conclusion—B C A.

TABLE 37.—*Yield of paddy.*

	No manure.	*Nightsoil compost.*	*Farmyard manure.*	*Significance.*
	A.	*B.*	*C.*	
Acre yield of grain in lb.	1,557	1,867	1,864	No.
Percentage on control ..	100	119·9	119·7	

Conclusian—B C A

TABLE 38.

	No manure.	*Nightsoil compost.*	*Farmyard manure.*	*Significance.*
	A.	*B.*	*C.*	
Yield of sugarcane in tons per acre.	41.0	53·1	52·8	Yes.
Percentage on control ..	100	129·6	128·7	

Conclusion—B C A

TABLE 39.—*Yield of paddy.*

	No manure.	*Compost.*	*Farmyard manure.*	*Significance.*
	A.	*B.*	*C.*	
Grain yield in lb. per acre.	3,992	3,186	3,287	Yes.
Percentage on control ..	100	103·0	106·3	
Straw yield in lb. per acre.	4,490	4,625	4,995	Yes.
Percentage on control ..	100	103·0	111·3	

Conclusion—Grain: C B A. Straw: C B A

TABLE 40.—*Yield of paddy.*

	No manure.	*Compost.*	*Farmyard manure.*	*Significance.*
	A.	*B.*	*C.*	
Grain yield in lb. per acre.	2,841	2,903	3,173	Yes.
Percentage on control ..	100	102·2	111·6	
Straw yield in lb. per acre.	4,526	4,696	5,162	Yes.
Percentage on control ..	100	103·8	114·0	

Conclusion—Grain: C B A. Straw: C B A

TABLE 41.—*Yield of paddy MTU 15.*

	No manure.	*Compost.*	*Farmyard manure.*	*Significance.*
	A.	*B.*	*C.*	
Grain yield in lb. per acre.	1,398	1,613	1,694	No.
Percentage on control ..	100	115·4	121·1	
Straw yield in lb. per acre.	2,205	2,330	2,603	No.
Percentage on control ..	100	105·6	118·2	

Conclusion—Grain: C B A. Straw: C B A.

TABLE 42.

	No manure.	*Cattle manure.*	*Compost.*	*Significance.*
	A.	*B.*	*C.*	
Groundnut pods in lb. per acre.	2,585	3,219	3,101	Yes.
Percentage on control ..	100	111·6	107·2	

Conclusion—B C A

TABLE 43.—*Yield of ragi.*

	No manure.	*Cattle manure.*	*Compost.*	*Significance.*
	A.	*B.*	*C.*	
Ragi grain in lb. per acre.	1,278	1,541	1,516	Yes.
Percentage on control ..	100	120·6	118·6	
Ragi straw in lb. per acre.	2,700	3,700	3,350	Yes.
Percentage on control ..	100	137·0	124·1	

Conclusion—Grain: B C A. Straw: B C A.

TABLE 44.—*Cumbu (Co. 3).*

	No manure.	*Cattle manure.*	*Compost.*	*Significance.*
	A.	*B.*	*C.*	
Grain yield in lb. per acre.	1,411	1,713	1,695	Yes.
Percentage on control ..	100	121·4	120·1	
Straw yield in lb. per acre.	5,122	6,585	6,829	Yes.
Percentage on control ..	100	128·5	133·3	

Conclusion Grain: $\overline{B\ C}$ A. Straw: $\overline{C\ B}$ A.

TABLE 45.—*Yield of paddy.*

	No manure.	*Cattle manure.*	*Compost.*	*Significance.*
	A.	*B.*	*C.*	
Acre yield of grain in lb..	2,097	2,324	2,196	Yes.
Percentage on control ..	100	111·4	104·8	

Conclusion B C A.

TABLE 46.

	No manure.	*Cattle manure.*	*Compost.*	*Significance.*
	A.	*B.*	*C.*	
Grain yield in lb. per acre	2,734	3,270	3,144	Yes.
Percentage on control ..	100	120	115	

Conclusion $\overline{B\ C}$ A

TABLE 47.—*Yield of paddy.*

Kattamodan paddy—

	No manure.	*Compost.*	*Cattle manure.*	*Significance.*
	A.	*B.*	*C.*	
Grain yield in lb. per acre	967	1,043	1,028	No.
Percentage on control ..	100	107·9	106·3	

Conclusion $\overline{B\ C}$ A,

TABLE 48.—*The bacterial population in differently manured O.P.M. soils.*

Treatments.	*Total counts in September.*	*Total bacterial counts in April.*
No manure soil	359,300	1,509,000
N plus P plus K soil	781,600	1,498,000
Cottle manured soil	964,700	1,927,000

TABLE 49.—*The biological activity in O.P. M. soils.*

Treatments.	*Control.*	*With dextrose.*	*Percentage increase due to dextrose.*
No manure	6·64	10·47	57·61
N plus P plus K	16·79	24·04	43·10
Cattle manure	16·19	15·88	— 1·90

TABLE 50.—*The bacterial population of red and black soils of Coimbatore.*

Particulars.	*Bacterial counts.*
Red soil from F.10B C.B. Station	708,600
Red soil from F.28 Central Farm	1,136,000
Black soil F. No. 36A Central Farm	600,000
Black soil from Pulse Section	901,000

TABLE 51.—*The biological activity in red and black soils of Coimbatore—(Mgm. CO_2 evolved per day).*

	Control.	*With dextrose.*	*Per cent increase due to dextrose.*
Red soil from F. 10B. C. B. Station ..	3·87	10·38	168·2
Red soil from F.28, Central Farm ..	8·73	19·99	128·9
Black soil from F. No. 36A Central Farm	13·07	17·82	36·37
Black soil from Pulse Section	10·52	19·71	87·42

TABLE 52.—*Showing the biological activity in soils from the Pulses Sub-station at Vizianagaram (Mgm. CO_2 evolved per day).*

	Control, i.e., without dextrose.	*With one per cent dextrose.*	*Per cent increase due to dextrose.*
1 First foot soil	19·67	22·75	15·66
2 Second foot soil	20·90	26·47	26·64
3 Third foot soil	19·89	26·73	34·41

TABLE 53.—*Results of analysis of soils from the agricultural research station Hagari, for alkalinity, pH and mechanical composition.*

G. 4 *Plot.*

	1	2	3	4	5	6	7	8
	FT.	FT.	FT.	FT.	FT.	FT.	FT.	FT.
Total solids ..	·1310	·1390	·1310	·0990	·0550	·0830	·0700	·060
(*a*)	·0324	·0283	·0283	..	..	..	..	..
(*b*)	..	..	..	..	..	..	..	..
(*c*)	·0378	·0420	·0215	Salts not estimated as total solids did not exceed 0·1 per cent.				
(*d*)	·0106	·0106	..					
(*e*)	·0170	·0237	·0201					
(*f*)	·0234	·0293	·0351					
Total salts	·1212	·1339	·1050					
Mechanical composition.								
(*g*)	59·64	58·49	42·90	20·26	5·53	11·90	13·50	8·3
(*h*)	36·98	39·57	55·94	79·18	96·94	89·76	87·52	92·4
(*i*)	3·36	1·94	1·16	0·56	Nil.	Nil.	Nil.	Nil
pH	8·1	8·45	8·8	8·55	8·45	8·85	8·0	8·
Moisture	6·1	6·06	4·44	1·78	0·25	0·83	1·10	0·8

G. 7 *Plot.*

	1	2	3	4	5	6	7	8
	FT.	FT.	FT.	FT.	FT.	FT.	FT.	FT.
Total solids ..	·0780	·0640	·1010	·1280	·1435	·1560	·1560	·220
(*a*)	..	..	·0283	·0080	·0202	·0486	·0405	·020
(*b*)	..	..	·0158	·0016	·0052	·0078	·0092	·003
(*c*)	..	..	·0113	·0711	·0639	·0568	·0493	·085
(*d*)	..	..	..	..	..	·0106	·0106	·010
(*e*)	..	..	·0164	·0176	·0195	·0038	·0103	·016
(*f*)	..	..	·0293	·0293	·0346	·0288	.0231	·080
Total salts ..	..	..	·1011	·1276	·1434	·1559	·1430	·217
Mechanical composition.								
(*g*)	19·68	22·84	57·09	60·77	64·28	69·61	71·44	82·4
(*h*)	79·91	77·93	41·87	37·15	32·99	29·03	28·03	17·1
(*i*)	0·41	Nil.	1·04	2·08	2·73	1·36	0·53	0·3
pH	8·6	8·5	8·7	8·7	8·8	8·85	9·0	9·
Moisture ..	1·89	2·14	5·32	5·38	5·88	6·47	6·35	7·7

G. 10 *Plot.*

	1	2	3	4	5	6	7	8
	FT.	FT.	FT.	FT.	FT.	FT.	FT.	FT.
Total solids ..	·0720	·0610	·1560	·1970	·2740	·2350	·2110	·091
(*a*)			·0243	·0202	·0486	·0162	·0243	
(*b*)			·0078	·0090	·0500	·0235	·0169	
(*c*)	Salts not estimated.		·0733	·1051	·0616	·0801	·0619	
(*d*)			·0106	·0159	·0159	·0530	·0530	
(*e*)			·0152	·0213	·0426	·0353	·0244	
(*f*)			·0231	·0231	·0288	·0231	·0346	
Total salts ..			·1543	·1946	·2475	·2312	·2151	
Mechanical composition.								
(*g*)	21·93	28·45	42·64	43·99	51·14	53·18	52·89	43·4
(*h*)	78·43	71·42	53·79	50·74	46·84	41·33	43·15	54·1
(*i*)	Nil.	0·13	3·57	5·27	2·02	5·49	3·96	2·4
pH	8·6	8·75	8·2	8·4	8·5	8·9	9·0	9·
Moisture	1·96	2·48	3·98	4·19	4·69	5·3	5·41	4·2

	G. 14 Plot.							
	1	2	3	4	5	6	7	8
	FT.	FT.	FT.	FT.	FT.	FT.	FT.	FT.
tal solids ..	·0930	·1520	·1960	·2450	·3200	·2860	·2620	·3560
(a)	..	·0243	·0202	·0283	·0243	·0243	·0202	·0202
(b)	..	·0039	·0169	·0086	·0054	·0003	..	..
(c)	..	·0860	·0712	·0964	·0801	·1109	·1113	·0782
(d)	..	0106	·0159	·0053	·0159	·0159	·0212	·0106
(e)	..	·0127	·0328	·0608	·0895	·0164	·0615	·0487
(f)	..	·0165	·0404	·0692	·0981	·0942	·0808	·1846
tal salts ..	..	·1540	·1974	·2686	·3133	·2620	·2950	·3423
	Mechanical composition.							
(g)	27·87	44·90	51·11	56·39	67·47	71·39	67·36	65·73
(h)	70·04	50·77	44·84	39·18	27·14	24·00	30·64	31·86
(i)	2·01	4·33	4·05	4·43	5·27	4·61	2·00	2·41
ph	8·7	8·8	8·9	8·8	9·0	9·1	9·2	9·1
isture	2·22	4·02	4·27	5·40	6·41	6·28	5·87	5·21

Explanatory Note.

(a) Calcium bicarbonate Ca $(HCO_3)_2$.
(b) Magnesium bicarbonate Mg $(HCO_3)_2$.
(c) Sodium bicarbonate $NaHCO_3$,
(d) Sodium carbonate $Na2CO_3$.
(e) Sodium sulphate $Na\ 2SO_4$.
(f) Sodium chloride Na Cl.
(g) Fine fraction.
(h) Coarse fraction.
(i) Loss by solution.

TABLE 54.—*Results of analysis of water samples from Hagari.*

Radicals—	*Parts per* 100,000	
	Water from G. 4 well.	*From pumping station well.*
Carbonates	0·6	1·2
Bicarbonates	51·24	23·18
Chloride	44·01	24·14
Sulphate	30·28	14·68
Calcium	11·80	5·20
Magnesium	3·06	0·87
Calculated Salts—		
Calcium bicarbonate	47·79	21·06
Magnesium bicarbonate	18·43	5·24
Sodium bicarbonate	..	4·06
Sodium carbonate	1·06	2·12
Sodium sulphate	44·78	21·72
Sodium chloride	72·54	39·78
Total ..	184·60	93·98
Total solids ..	162·40	87·0
ph ..	7·6	7·4

TABLE 55.—*Samples Reported.*

Details.	*Number of samples.*
(1)	(2)
I. A & D Block samples (wet lands)—	
(i) Green manure plants	8
(ii) Leaf, stem of green manure plants	16
(iii) Soils	60
II. Green manure seeds	8
III. Vizianagaram samples—	
(i) Plant materials	128
(ii) Soils	40
IV. Wynad—	
(i) Soil	1
V. Seethambalpuram—	
(i) Soils	80*
VI. Pattukkottai—	
(i) Soil	1
(ii) Water	1
VII. Siruguppa—	
(i) Soils	172*
(ii) Water	74*
VIII. Hagari—	
(i) Water samples	3
(ii) Soils	32
IX. From Central Farm and Cotton Station—	
(i) Soils	3
X. O.P.M.—	
(i) Soils	6
Total ..	633

* These samples have been included in the list of main section.

TABLE 56.—*Results of comparative value of common green manure crops experiment.*

1950–51.

GREEN MANURE.

Summary of Conclusions.

Field—A Block wet lands.
Layout—4×4 randomized plots.
Size of plot—5 cents.
Variants—Dhaincha, pillipesara, sunnhemp, cowpea.

Particulars.	*Sunnhemp.*	*Pillipesara.*	*Dhaincha.*	*Cowpea.*	*Control.*	*General mean.*	*"Z" test satisfied or not.*	*Standard error.*	*Critical difference.*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Green matter—									
Yield in lb./acre	21,500	19,960	18,805	15,385	..	17,680	No.	3330·4	753·2
Percentage on general mean.	121·6	112·9	106·4	87·04	..	100	..	18·83	42·6

Particulars.	*Sunnhemp.*	*Dhanicha.*	*Pillipesara.*	*Cowpea.*	*Control.*	*General mean.*	*"Z" test satisfied or not.*	*Standard error.*	*Critical difference.*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dry matter—									
Yield in lb./acre	4,884	3,885	2,820	2,279	..	3,220	No.	719·2	1,626·8
Percentage on general mean.	151·7	119·8	87·56	70·76	..	100	..	22·31	50·52

PADDY.

Summary of Conclusions.

Field—A Block wet lands.
Layout—5 cents.
Size of plot—5 × 4 randomized plots.
Variants—Dhaincha, pillipesara, sunnhemp, cowpea.
Variety—G.E.B. 24.

Particulars.	*Cowpea.*	*Dhaincha.*	*Sunnhemp.*	*Pillipesara.*	*Control.*	*General mean.*	*"Z" test satisfied or not.*	*Standard error.*	*Critical difference.*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Grain—									
Yield in lb./acre	3,810	3,643	3,530	3,443	2,426	3,280	Yes.	188·6	411
Percentage on control ..	157·1	150·3	145·6	142·1	100	..	..	77·75	169·3
Straw—									
Yield in lb./acre	5,740	4,850	4,383	4,035	2,888	5,220	Yes.	548·6	1,195·6
Percentage on control ..	198·6	167·8	151·7	139·6	100	..	..	19·0	41·45

Conclusion—Grain : Pillipesara, Dhaincha, Sunnhemp, Cowpea, Control.

Straw : Pillipesara, Dhaincha, Sunnhemp, Cowpea, Control.

TABLE 57.—*Results of comparative value of common green manure crops experiments.*

1950–51.

GREEN MANURE.

Summary of Conclusions.

Field—D Block wet lands.
Layout—4 × 5 randomized plots.
Size of plot—5·2 cents.
Variants—Dhaincha, pillipesara, sunnhemp, cowpea.

Particulars.	*Dhaincha.*	*Sunnhemp.*	*Cowpea.*	*Pillipesara.*	*Control.*	*General mean.*	*"Z" test satisfied or not.*	*Standard error.*	*Critical difference.*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Green matter—									
Yield in lb./acre	17,118	10,132	8,930	6,738	..	9,634	Yes.	2,707	4,907
Percentage on general mean..	177·8	105·2	92·74	69·97	..	100	..	28·09	50·93
Conclusions—Dhaincha, sunnhemp, cowpea, pillipesara.									
Dry matter—									
Yield in lb./acre	4,441	2,534	1,327	1,022	..	2,134	Yes.	639·6	1,393
Percentage on general mean..	208·1	118·8	62·19	47·88	..	100	..	29·97	65·28
Conclusions—Dhaincha, sunnhemp, cowpea, pillipesara.									

PADDY.

Summary of Conclusions.

Field—D Block wet lands.
Layout—5 × 5 randomized plots.
Size of plot—5·2 cents.
Variants—Dhaincha, pillipesara, sunnhemp, cowpea.
Variety—G.E.B. 24.

Particulars.	*Dhaincha.*	*Cowpea.*	*Pillipesara.*	*Sunnhemp.*	*Control.*	*General mean.*	*"Z" test satisfied or not.*	*Standard error.*	*Critical difference.*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Grain—									
Yield in lb./acre	3,019	3.019	2,846	2,750	2,384	2,808	Yes.	184·4	390·7
Percentage on control ..	129·6	129·6	119·3	115·3	100	..	..	7.734	16·39
Conclusions—Dhaincha, cowpea, pillipesara, sunnhemp, control.									

Particulars.	*Dhaincha.*	*Sunnhemp.*	*Cowpea.*	*Pillipesara.*	*Control.*	*General mean.*	*"Z" test satisfied or not.*	*Standard error.*	*Critical difference.*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Straw—									
Yield in lb./acre	5,539	4,807	4,481	4,288	3,500	4,520	No.	660·6	140·1
Percentage on control ..	158·2	137·3	128·0	122·5	100	..	..	18·85	4·002

TABLE 58.—*Showing the yield of green manure, the nitrogen precentage and total nitrogen content of different parts of green manure plants and the total nitrogen added to soil in A and D Blocks wetlands in the green manure trials.*

1950–51.

(1)	Whole plant.				Stem.				Leaf.				Total nitrogen in both the leaves and stem in lb./acre. (14)
	Wet weight in lb./acre. (2)	Dry weight in lb./acre. (3)	Percentage of nitrogen. (4)	Total nitrogen lb./acre. (5)	Wet weight in lb./acre. (6)	Dry weight in lb./acre. (7)	Percentage of nitrogen. (8)	Total nitrogen lb./acre. (9)	Wet weight in lb./acre. (10)	Dry weight in lb./acre. (11)	Percentage of nitrogen. (12)	Total nitrogen lb./acre. (13)	
					A Block.								
Dhaincha ..	18,805	3,855	1·93	74·40	12,960	2,465	1·48	36·48	5,845	925	3·80	35·15	71·63
Pillipesara ..	19,960	2,820	2·53	71·35	10,850	1,754	1·97	34·55	9,110	1,103	3·34	36·84	71·39
Sunnhemp ..	21,500	4,884	1·80	87·91	12,000	3,185	1·29	41·09	9,500	1,522	3·08	46·88	87·97
Cowpea	15,385	2,279	2·33	53·10	10,180	2,006	1·32	26 48	5,205	912	2·92	26·63	53·11
					D Block.								
Dhaincha ..	17,118	4,441	2·35	104·36	13,270	3,803	2·08	79·10	3,848	778	3·40	26·47	105·57
Pillipesara ..	6,738	1.022	3·74	38·22	3,386	584	2·00	11·68	3,352	625	4·46	28·08	39·76
Sunnhemp ..	10,132	2,534	2·02	51·19	6,451	1,972	1·37	26·92	3,681	892	3·10	27·67	54·59
Cowpea	8,930	1,327	2·39	31·81	5,547	969	1·55	15·01	3,383	547	3·04	16·61	31·62

TABLE 59.—*Showing succulency and decomposability of green manures.*

Name of green manure.	A Block.			D Block.		
	Original moisture.	Stem : Leaf.	Mgm. CO_2 per day.	Original moisture.	Stem : Leaf.	Mgm. CO_2 per day.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dhaincha	79·50	1:0·45	10·92	74·06	1:0·29	13·83
Pillipesara	85·87	1:0·84	26·83	84·83	1:0·99	30·54
Sunnhemp	77·28	1:0·79	24·86	74·97	1:0·57	25·82
Cowpea	85·18	1:0·51	45·97	85·14	1:0·61	36·93

TABLE 60.—*Yield of green manure and nitrogen added to soils in the green manure experiments during the years* 1948–49, 1949–50 *and* 1950–51.

Green Manure.	Yield of green manure in lb./acre.			Nitrogen. per cent.			Nitrogen added in lb./acre.		
	1948–49	1949–50	1950–51	1948–49	1949–50	1950–51	1948–49	1949–50	1950–51
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				A Block.					
Dhaincha	18,665	21,120	18,805	2·57	2·38	1·93	132·7	94·75	74·40
Pillipesara	18,648	21,305	19,960	2·56	3·41	2·53	101·9	105·40	71·35
Sunnhemp	21,605	27,790	21,500	2·26	1·75	1·80	133·8	104·90	87·91
Cowpea	20,438	21,055	15,385	2·31	2·65	2·33	74·1	69·66	53·10
				D Block.					
Dhaincha	30,895	21,131	17,118	1·76	2·68	2·35	115·6	112·40	104·36
Pillipesara	20,821	22,337	6,738	2·46	2·59	3·74	56·6	84·34	38·22
Sunnhemp	13,167	25,816	10,132	1·52	1·53	2·02	48·6	78·72	51·19
Cowpea	22,253	19,246	8,930	1·88	2·53	2·39	50·5	71·86	31·81

TABLE 61.—*Showing the biological activity and bacterial counts of G.M. experiment soils.*

A. BLOCK WET LANDS, 1950–51.

Treatment.	(a)	(b)	(c)	(a)	(d)	(c)	(a)	(b)	(c)
	Before G. M. Sowing.			*After G. M. Harvest.*			*After Paddy Harvest.*		
				Surface soil.					
(i)	11·72	88·61	486,300	13·22	149·9	2,797,000	18·21	262·3	1,759,000
(ii)	17·28	173·64	533,900	18·48	249·3	1,512,000	26·27	428·0	1,782,000
(iii)	23·34	269·40	815,800	11·33	114·1	1,314,000	38·32	662·2	1,663,500
(iv)	20·50	224·50	1,035,000	17·05	222·3	..	36·14	618·0	1,398,000
(v)	6·32	..	599,600	5·29	..	1,092,000	5·15	..	1,480,000
				Sub-soil.					
(i)	11·82	195·7	543,100	11·11	132·8	686,100	15·52	213·3	1,101,00
(ii)	17·12	329·8	323,400	17·91	275·2	482,700	28·13	368·1	790,900
(iii)	13·09	227·5	293,700	22·11	363·2	834,700	35·32	487·6	442,900
(iv)	20·69	417·5	323,800	28·6	449·2	703,600	26·63	342·1	271,000
(v)	4·0	..	357,800	4·77	..	404,200	6·01	..	482,700

D. BLOCK WET LANDS 1950–51.

				Surface soil.					
(i)	14·1	127·5	468,200	14·2	215·6	2,797,000	16·17	175·5	1,438,000
(ii)	24·8	300·0	514,100	19·2	326·7	1,515,00	20·28	245·9	1,78,800
(iii)	28·7	362·9	223,700	27·8	517·8	1,907,000	22·13	277·0	495,000
(iv)	25·6	312·9	456,800	22·1	391·6	..	31·42	435·3	669,200
(v)	6·2	..	620,900	4·5	..	1,135,900	5·87	..	647,600
				Sub Soil.					
(i)	10·91	154·3	605,200	12·5	145·1	687,000	13.93	90·78	257,000
(ii)	17·00	296·2	793,000	17·1	235·6	482,000	25·55	250·00	537,000
(iii)	16·9	293·9	714,000	23·3	490·1	834,000	26·95	269·1	1,587,000
(iv)	24·5	471·1	414,700	32·8	543·0	703,600	25·05	243·1	1,187,000
(v)	4·29	..	126,600	5·1	..	404,200	7·30	..	709,800

NOTE.—Treatment (i) Dhaincha ; (ii) Pillipesara ; (iii) Sunnhemp ; (iv) Cowpea (v) Control. (a) Mgm. Co2 per day ; (b) per cent increase over control ; (c) Total bacterial counts per dry gm.

TABLE 62.—*Showing the results of experiments on the associated growth of cholam and pulses in different proportions at the Pulse Sub-station, Vizianagaram. 1950–51.*

Treatment.	Yield per acre.				Total produce of both crops.			
	Cholam.		Pulse.					
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
			Redgram srries.					
(1) Pure pulse	..	..	735	2,992	735	2,992	3,727	146
(2) $P\frac{3}{4}$ plus $C\frac{1}{4}$	408	10,506	238	1.564	646	12,070	12,716	236
(3) $P\frac{1}{2}$ plus $C\frac{1}{2}$	476	12,376	85	1,052	561	12,428	12,939	238
(4) $P\frac{1}{4}$ plus $C\frac{3}{4}$	527	12,308	150	850	677	13,158	13,835	252
(5) Pure cholam	544	11,124	..	..	544	11,124	11,668	207
			Lab-lab series.					
(1) Pure pulse	..	..	211	2,110	211	2,110	2,321	33
(2) $P\frac{3}{4}$ plus $C\frac{1}{4}$	612	9,146	157	755	769	9,901	10,670	244
(3) $P\frac{1}{2}$ plus $C\frac{1}{2}$	578	12,376	67	951	645	13,327	13,972	240
(4) $P\frac{1}{4}$ plus $C\frac{3}{4}$	612	11,322	80	606	692	11,928	12,620	231
(5) Pure cholam	816	11,424	..	..	816	11,424	12,240	245
			Greengram series.					
(1) Pure pulse	..	..	10	544	10	544	554	7
(2) $P\frac{3}{4}$ plus $C\frac{1}{4}$	1,088	16,320	2	272	1,090	16,592	17,682	345
(3) $P\frac{1}{2}$ plus $C\frac{1}{2}$	1,020	15,402	2	208	1,022	15,610	16,632	322
(4) $P\frac{1}{4}$ plus $C\frac{3}{4}$	952	15,300	2	138	954	15,438	16,392	312
(5) Pure cholam	986	15,130	..	..	986	15,130	16,116	312
			Blackgram series.					
(1) Pure pulse	..	..	95	1,904	95	1,904	1,999	18
(2) $P\frac{3}{4}$ plus $C\frac{1}{4}$	1,247	14,076	4	374	1,245	14,450	15,695	335
(3) $P\frac{1}{2}$ plus $C\frac{1}{2}$	1,292	14,552	2	374	1,294	14,892	16,186	247
(4) $P\frac{1}{4}$ plus $C\frac{3}{4}$	952	15,912	34	408	986	16,320	17,306	326
(5) Pure cholam	578	14,390	..	..	578	14,390	14,968	252

NOTE.—(*a*) = Grain in lb./acre ; (*b*) = Straw in lb./acre; (*c*) = Grain in lb./acre; (*d*) = Stalks and Bhusa in lb./acre ; (*e*) = Grain in lb./acre ; (*f*) Straw, Stalks and Bhusa in lb./acre; (*g*) = Total plant material from both crops in lb./acre ; (*h*) = Value of produce obtained from both crops/acre in rupees.

Treatment.	Surface soil.				Sub-soil.			
	Before sowing.	After harvest.	Increase or decrease.	Increase or decrease per cent.	Before sowing.	After harvest.	Increase or decrease.	Increase or decrease per cent.
Blackgram series.								
Pulse alone	0.052	0.038	— 0·014	— 26·9	0·050	0·051	+ 0·001	+ 2·0
P¾ plus C¼	0·051	0·043	— 0.008	— 15.7	0·047	0·046	— 0·001	— 2·1
P½ plus C½	0.054	0.043	— 0·011	— 20·4	0·052	0·051	— 0·001	— 1·9
P¼ plus C¾	0·046	0·034	— 0·012	— 26·1	0·043	0·051	+ 0·008	+ 18·6
Cholam alone	0·054	0·034	— 0·020	— 35·7	0·050	0·057	+ 0·007	+ 14·0
Greengram series.								
Pulse alone	0.049	0·039	— 0·010	— 20·4	0·044	0·051	+ 0·007	+ 15·9
P¾ plus C¼	0·054	0·041	— 0·013	— 24·1	0·051	0·049	— 0·002	— 3·9
P½ plus C½	0·049	0·045	— 0·004	— 8·2	0·043	0·051	+ 0·008	+ 18·6
P¼ plus C¾	0·054	0·039	— 0·015	— 27·8	0·047	0·041	— 0·006	— 12·8
Cholam alone	0·053	0·043	— 0·010	— 18·9	0·044	0·036	— 0·008	— 18·2
Lab-lab series.								
Pulse alone	0·047	0·033	— 0.014	— 29·8	0·049	0·050	+ 0·001	+ 2·0
P¾ plus C¼	0·044	0·046	+ 0·002	+ 4·5	0·045	0·045	Nil.	Nil.
P½ plus C½	0·040	0·043	+ 0·003	+ 7·5	0·050	0·043	— 0·007	— 14·0
P¼ plus C¾	0·046	0·039	— 0·007	— 15·2	0·049	0·044	— 0·005	— 10·2
Cholam alone	0·041	0·041	Nil.	Nil.	0·049	0·058	+ 0·009	+ 18·4
Redgram series.								
Pulse alone	0·049	0·040	— 0·009	— 18·4	0·044	0·051	+ 0·007	+ 15·9
P¾ plus C¼	0·041	0 041	Nil.	Nil.	0·050	0·052	+ 0·002	+ 4·0
P½ plus C½	0·042	0·048	+ 0·006	+ 14·3	0·048	0·051	+ 0·003	+ 6·3
P¼ plus C¾	0·044	0·048	+ 0·004	+ 9·1	0·047	0·053	+ 0 004	+ 8·2
Cholam alone	0·044	0·045	+ 0·001	+ 2·3	0·043	0·053	+ 0·010	+ 23·3

TABLE 63.—*Showing the results of studies on physiological characters of paddy plants treated with different green manures A and D blocks wet lands (average of 60 plants)*, 1950–51.

A. Block.

Particulars.	*Control plot.*	*Dhaincha plot.*	*Pillipesara plot.*	*Sunnhemp plot.*	*Cowpea plot.*
(1)	(2)	(3)	(4)	(5)	(6)
Distance between plants.	3″	5″	4″	6″	4″
Number of tillers ..	5·5	5·9	6·8	6·2	5·3″
Height of plant	35·5″	48·2″	47·9″	42·7″	40·3″
Length of panicle ..	8·2″	10·7″	9·2″	9·3″	9·1
Number of grains ..	296	565·2	530·8	449.7	328·3

D. Block.

Particulars.	*Control plot.*	*Dhaincha plot.*	*Pillipesara plot.*	*Sunnhemp plot.*	*Cowpea plot.*
Distance between plants.	3·4″	3·2″	3·4″	3·4″	3·3
Number of tillers ..	4·9	5·8	5·7	5·8	5.5″
Height of plant	36·6″	42·0″	39·6″	40·1″	39.3″
Length of panicle ..	7·5″	7·9″	7·7″	7·9″	7·7″
Number of grains ..	310	409	397	414	374

TABLE 64.—*Showing the percentage of total nitrogen content of plant materials from the associated growth of cholam and pulses experiment at Vizianagaram*, 1949–50.

Series.	*Treatments.*				
	Pure pulse.	$P\frac{3}{4}+C\frac{1}{4}$.	$P\frac{1}{2}+C\frac{1}{2}$.	$P\frac{1}{4}+C\frac{3}{4}$.	*Pure cholam.*
(1)	(2)	(3)	(4)	(5)	(6)
Pulse : Grains.					
Blackgram	4·48	4·58	4·59	4·28	..
Greengram	4·28	4·06	4·40	4·38	..
Lab-lab	3·96	3·92	3·87	4·84	..
Redgram	3·85	3 82	3·79	3·77	..
Pu'se : Bhusa.					
Blackgram	1·83	1·69	1·58	1·77	..
Greengram	1·60	1·59	1·75	1·78	..
Lab-lab	2·00	1·80	2·00	2·04	..
Redgram	1·96	1·88	1·63	1·90	..
Pulse : Shoot (stems and leaves).					
Blackgram	1·43	1·65	1·56	1·87	..
Greengram	1·51	1·36	1·48	1·27	..
Lab-lab	1·26	1·13	1·35	1·17	..
Redgram	0·43	0·43	0·47	0·39	..
Pulse : Stem.					
Blackgram	0·38	0·23	0·25	0·20	..
Greengram	0·23	0·30	0.25	0·25	..
Lab-lab	0·30	0·28	0·25	0 25	..
Redgram	0·17	0·18	0·21	0·14	..

Series.	Pure pulse.	$P\frac{1}{2}+C\frac{1}{2}$.	$P\frac{1}{2}+C\frac{1}{4}$.	$P\frac{1}{4}+C\frac{1}{4}$.	Pure cholam.
(1)	(2)	(3)	(4)	(5)	(6)
		Pulse : Root.			
Blackgram	0·47	0·62	0·66	0·38	..
Greengram	0·54	0·66	0·55	0·54	..
Lab-lab	0·66	0·71	0·56	0·40	..
Redgram	0·57	0·36	0·46	0·32	..
		Cholam : Earheads.			
Blackgram		0·69	0·67	0·65	0·69
Greengram		0·78	0·73	0·79	0·78
Lab-lab		0·77	0·76	0·74	0·79
Redgram		0·85	0·85	0 67	0·69
		Cholam : Grain.			
Blackgram		1·80	1.87	1·75	1·86
Greengram		1·83	1·79	1·80	1·63
Lab-lab		1·81	1·82	1·75	1·63
Redgram		1·64	1·70	1·73	1·71

TABLE 65.—*Showing the different bacterial cultures supplied during the year* 1950–51.

Serial number and name.	Total for the year.
(1)	(2)
1 Dhaincha	54
2 Pillipesara	8
3 Sunnhemp	4
4 Lucerne	40
5 Berseem	20
6 Blackgram	45
7 Red gram	6
8 Horse gram	5
9 Lab lab	1
10 Green gram	8
11 Groundnut	99
12 Lotus	5
13 Indigo	9
Total ..	304

TABLE 66.—*Average rate of growth of two strains of Aspergillus Oryzae in solid media.*

Period in days.	Strain 558.	Strain 595.
7	6·0 cm.	6·6 cm.

(In liquid media of 20 cc. sucrose nitrate solution of Czapeks.)

	Period in days.	Strain 558.	Strain 595.
Growth	45	166·3 mgm.	248·6 mgm.
pH at start ..	3·9	9·15	9·19

TABLE 67.—*Disatasic power in lintner units.*

Composition of media.	*Strain* 558.	*Strain* 595.
Wheat bran plus 10 per cent groundnut cake alone.	128·9	102·0
Wheat bran plus 10 per cent groundnut cake plus 1 per cent Am 804.	45·4	23·3
Wheat bran plus 10 per cent groundnut cake plus 10 per cent malt refuse.	57·6	28·3

TABLE 68.—*Granule size of starches prepared from rice grown under different manurial treatment.*

Step interval (Micra).	I *No manure.* FREQUENCY.			II *Green manure at 10,000 lb. per acre.* FREQUENCY.			III *Ammonium sulphate N = that in II.* FREQUENCY.		
	(*a*)	(*b*)	(*c*)	(*a*)	(*b*)	(*c*)	(*a*)	(*b*)	(*c*)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
3·70 ..	23	4·6	4·6	16	3·2	3·2	4	0·8	0·8
4·07 ..	6	1·2	5·8	1	0·2	3·4	1	0·2	1·0
4·44 ..	97	19·4	25·2	129	25·8	29·2	83	16·6	17·6
4·81 ..	8	1·6	26·8	21	4·2	33·4	5	1·0	18·6
5·18 ..	68	13·6	40·4	56	11·2	44·6	71	14·2	32·8
5·55 ..	17	3·4	43·8	22	4·4	49·0	26	5·2	38·0
5·92 ..	89	17·8	61·6	81	16·2	65·2	56	11·2	49·2
6·29 ..	46	9·2	70·8	35	7·0	72·2	27	5·4	54·6
6·66 ..	74	14·8	85·6	81	16·8	88·4	113	22·6	77·2
7·03 ..	2	0·4	86·0	..	..	..	5	1·0	78·2
7·40 ..	70	14·0	100·0	58	11·6	100	109	21·8	100·0
Total ..	500	100·0	100·0	500	100·0	100·0	500	100·0	100·0

(*a*)=Number. (*b*)=Per cent. (*c*)=Accumulated frequency per cent.

TABLE 69.—*Feeding values of rice and straw obtained from rice grown under no manure, green manure and ammonium sulphate.*

Heads of Analysis.	RICE. *No manure.*	*Green manure.*	*Ammonium sulphate.*	STRAW. *No manure.*	*Green manure.*	*Ammonium. sulphate.*
Moisture	11·79	11·96	11·81	6·75	6·74	6·39
Ash	1·61	1·63	1·57	16·74	17·77	17·05
Crude proteins ..	7·09	7·33	6·93	2·31	2·38	2·13
Ether extractives ..	2·91	3·48	2·97	1·57	1·54	1·53
Crude fibre	0·68	0·52	0·61	3·16	3·15	3·15
Carbohydrates (by diff)	75·92	75·08	76·11	69·47	68·42	69·75
Total ..	100·00	100·00	100·00	100·00	100·00	100·00
Alhuminoids ..	6·95	7·20	6·77	2·21	2·26	1·99
Insolubles, per cent ..	0·22	0·19	0·16	15·18	15·45	15·22
Lime Cao, per cent ..	0·05	0·04	0·04	0·11	0·13	0·12
P 205, per cent ..	0·72	0·78	0·67	0·09	0·13	0·10
K 20, per cent ..	0·27	0·30	0·25	0·69	1·16	0·81
Acid value	30·54	31·03	26·20	77·35	81·25	81·25

TABLE 70.—*Strength of staff as on 30th June 1951.*

Name of service and post.	*Number of sanctioned posts.*	
	Permanent.	*Temporary.*
I. Madras Agricultural Service—		
Government Agricultural Chemist	1	..
Assistant Agricultural Chemists	3	..
Agricultural Bacteriologist	1	..
Soil Physicist	1	..
Gazetted Assistant in Chemistry	1	..
Total	7	..
II. Madras Agricultural Subordinate Service—		
Upper subordinates—Main section	18	..
,, Tungabhadra Project	1	..
,, Teaching Section	..	1
,, Compost Scheme	..	2
,, Scheme for improvement of potatoes in Nanjanad	..	1
,, Increased staff for clear off arrears of samples	..	4
,, Soil Survey Scheme	..	2
,, Control of price and quality of manures	..	1
Total	19	11
III. Madras General Subordinate Service—		
Laboratory Attenders—Main section	7	..
,, Teaching section	..	2
,, Compost	..	1
,, Manure Scheme	..	1
,, Soil Survey	..	1
,, Increased staff for Clear off arrears of samples	..	2
Total	7	7
IV. Madras Ministerial Service—		
Upper Division Clerk—Compost Scheme	..	1
Lower Division Clerk—Main section	3	..
,, Manure Scheme	..	1
Total	3	2
V. Madras Inferior Service—		
Peons—Main section	7	..
,, Compost scheme	..	1
Total	7	1

COIMBATORE,
10th August 1951.

M. SANYASI RAJU,
Government Agricultural Chemist.

ADMINISTRATION REPORT OF THE GOVERNMENT ENTOMOLOGIST FOR THE YEAR 1950–51.

Detailed Report.

I. GENERAL.

(*a*) *Charge.*—I rejoined duty as Government Entomologist on 14th August 1951 after expiry of leave, relieving Sri V. Tirumal Rao and continued to be in charge of the section for the rest of the period under report.

(*b*) *Staff.*—Sri K. P. Ananthanarayanan, Gazetted Assistant, was transferred as Crop and Plant Protection Officer (Entomology), Coimbatore, *vice* Sri E. R. Gopala Menon, who was posted in the above vacancy. Sri N. Raghava Rao and Sri K. R. Nagarajan, Assistants, officiated in the Madras Agricultural Service for varying periods in leave vacancies. Sri P. S. Thejomurthy, Assistant, was transferred as Agricultural Demonstrator, Arakonam and Sri S. Kanakaraj David reposted in his place. Srimathi A. Leela David rejoined duty after the expiry of leave in place of Sri P. Chandrasekharan, who was transferred as Farm Manager, Central Farm. Sri S. Kanakaraj David was promoted to the Madras Agricultural Service and posted as Assistant Lecturer, Bapatla. Sri K. V. Sekharan was appointed in the above vacancy and was subsequently transferred as Assistant, Orange Borer Scheme, Kalpetta, *vice* Sri P. K. Vijayan posted as Farm Manager, Taliparamba. Sri N. Raghava Rao was posted in the vacancy of Srimathi A. Leela David, who was transferred as Assistant in Entomology, Agricultural College, Bapatla. Sri E. V. Abraham and Sri S. Krishnaswamy joined as Assistants in Entomology in existing vacancies. Sri K. R. Nagarajan, Assistant, was taken over to the Biological Control Scheme with effect from 25th June 1951 and Sri E. V. Abraham posted for the sugarcane work.

(*c*) *Leave.*—Some of the Gazetted Officers and staff were on earned leave for various periods during the year.

(*d*) *Tours.*—The Government Entomologist attended the meeting of the Committee of Entomologists of the Indian Council of Agricultural Research during November 1950 at New Delhi. Sri A. R. Seshadri, Assistant Entomologist, was deputed on tour to New Delhi during September 1950 for the collection of literature on Thysanoptera. Besides these, the Government Entomologist and the staff were on tour for varying periods in connection with the investigations of crop pests, attending meetings, etc.

(*e*) *Advisory.*—A number of enquiries on pest problems as well as bee-keeping were received and necessary action taken.

(*f*) *Exhibitions.*—The section took part in some of the important exhibitions such as the Park Fair Exhibition, Madras, Farmer's Day Exhibition at Coimbatore, etc. A comprehensive

show depicting the activities of the Section was put up during July 1950 in connection with the College Day and Conference at Coimbatore.

II. RESEARCH.

A. Investigations on crop pests.

Remarkable strides were made during the previous year in exploiting the adaptability of the new chemicals—DDT and BHC —for the control of insect forms which feed externally and the results in most cases, have been so convincing that the methods were spontaneously transmitted to the ryots by the Plant Protection Staff. With the background of knowledge about the enormous potentialities of these insecticides, attention was concentrated during the year under review, on the internal forms like borers, which are not easily accessible for insecticidal treatments. A few other insects like Aphids and Coccids which are equally difficult to control were also investigated. Conclusive results against two or three of the major pests of fruit trees have been achieved. A tentative findings against the paddy stem-borer offer sufficient encouragement for further work. Along the two insecticides mentioned above, some of the more recent formulations like Parathion, HETP, etc., which are reported to be more potent were also given a fair trial. But research on the latter could not be pursued to conclusive ends because of the small quantities available.

The details of work done during the year under report are furnished below crop war :—

(*a*) *Pests of rice.*

(i) *The rice stem borer* (*Schoenobius incertellus W*).—This is one of the major pests of rice occurring often in a servere form on the longer duration varieties like Samba and Thaladi in Tanjore district. The pest was studied at the Agricultural Research Station, Aduthurai. A light trap was set up throughout the season to note the periods of the heavy emergences of the moths. The general indications of the progress of the pest are that the initial infestation takes place during the seed-bed stage, the egg-laying being concentrated on the tips of the seedlings. The second brood emerges by about November when the crop is in shot-blade. The damage at this stage is more serious as it manifests itself by the occurrence of the empty earheads. The control measures were till recently based on phototropic principles for the adults and on mechanical methods like collection and destruction of the egg-masses and the infested plants as well. As these were far from perfect, exploratory trials with BHC and DDT were conducted during the previous season. The results were fairly indicative and the plan of work was further elaborated during the current season. The main object of the experiments was to see

whether a judicious application of the chemicals would confer any relief either by their deterrent action on the adults or by the residual lethal effects on the young caterpillars hatching out of the egg masses laid on the plants.

The seed-beds of the Samba crop were sprayed once with 0·1 and 0·05 per cent concentrations of BHC and DDT and the seedlings planted in randomized replicated plots. A second spray was given at the shot-blade stage. The Thaladi nurseries were treated twice with the above formulations and the seedlings planted similarly. Besides the experimental plots, five bulk fields also were planted with the treated Thaladi seedlings and the observations continued on these also. A second spray was also given to this crop when it was in shot-blade. Fortnightly counts of the progressive infestation in the sprayed and control plots were recorded and a gist of the findings is furnished below :—

Results of the Trials on the Samba Crop (Randomized plots).

Treatments.	*Total nnmber of infested tillers.*	*Total number of egg masses.*	*Total number of larvae.*
1 BHC 0·1 per cent spray ..	298	3	222
2 BHC 0·05 „ „ ..	429	10	32
3 DDT 0·1 „ „ ..	504	10	46
4 DDT 0·05 „ „ ..	617	18	68
5 Control	1,150	40	103

Results of the Trials on the Thaladi Crop (Randomised plots).

Treatments.	*Total number of infested tillers.*	*Total number of egg masses.*	*Total number of larvae.*
1 BHC 0·1 per cent spray	993	6	66
2 BHC 0·05 „ „	1,153	8	102
3 DDT 0·1 „ „	1,317	15	116
4 DDT 0·05 „ „	1,669	28	152
5 Control	2,405	47	205

Results of the Trials on the Thaladi Crop (Bulk area).

Treatments.	*Total number of infested tillers.*	*Total number of egg masses.*	*Total number of larvae.*
1 BHC 0·1 per cent spray	2,959	16	103
2 BHC 0·05 „ „	3,996	9	108
3 DDT 0·1 „ „	5,195	16	101
4 DDT 0·05 „ „	5,776	23	112
5 Control	5,929	27	136

On a detailed calculation of the data of the experimental plots, it was found that the ultimate percentages of infestation on the Samba crop were 3·3, 2·64, 2·3 and 1·56 for DDT 0·05, 0·1, BHC 0·05 and 0·1 per cent as against 6·1 on the controls. Similarly the respective percentages for the Thaladi crop were 9·58, 7·5, 6·49 and 5·61 as against 14·2 in the controls. The data on the whole indicate that the borer has been warded off to a greater extent in the BHC 0·1 per cent plots.

The experiments are being continued during the current year (1951–52) on a more elaborate basis with the addition of one or two of the latest chemicals.

A cursory attempt was also made to study the varietal resistance. The respective percentages of infestation for ADT 1,2,8 and Co.19 and 25 were 25·0, 29·9, 35·6, 23·9 and 31·3. General observations were also continued to find out as to how the pest tides over the off-season but no additional information of interest was available.

(ii) *The rice mealy bug* (*Ripersia oryzae Gr.*).—These bugs did not occur on a serious form, at the Agricultural Research Station, Aduthurai. As such, the results obtained from the control experiments are not conclusive. The first set of trials consisted of scorching the nursery bunds to prevent the initial infestation from the grasses growing there. The seedlings were transplanted in separate fields and the progress of the pest was noted. Another set of seed beds were treated with 5 per cent dusts and 0·1 per cent and 0·2 per cent sprays of BHC and DDT and the effects noted on the transplanted crop. The results in both these cases were not convincing. A few badly infested patches were also marked out and sprayed with the concentrations mentioned above. As the bugs were located safely inside the leaf-sheaths, the results were not encouraging, though a mortality ranging from 32·5 per cent to 46·5 per cent was recorded in the case of BHC 0·2 per cent sprays.

(iii) *The Kodu fly* (*Pachydiplosis oryzae W*).—Experiments were conducted on the control of this pest at Ungathur (West Godavari district) over a compact block of eighty acres. The incidence of the pest was watched from September onwards and one round of insecticidal treatment given when the virulence of the pest showed signs of increase. The variants were BHC 5 per cent dust and spray at 0·05 and DDT spray at 0·1 per cent. The incidence was assessed by weakly counts. No tangible results could be obtained owing to the very low incidence of the pest. The trials will be repeated during the next season.

(iv) *The Rice jassid* (*Nephotettix bipunctatus F*).—The comparative merits of DDT, BHC and Toxaphene were tried on a small scale against this pest. The variants were Toxaphene dust 20 per cent DDT dust 1 to 5 per cent, BHC dust 5 per cent and DDT, BHC sprays at 00·5 per cent. The specific action of DDT was confirmed, the reduction ranging from 52 to 78 per cent according to the concentration, while it was only about 50 per cent in the case of BHC. The results of Toxaphene were convincing (82 per cent) but the practical utility of this chemical cannot be thought of because of its prohibitive cost.

(v) *The rice thrips* (*Thrips oryzae W*).—Cases of minor incidence of this insect were treated with BHC and DDT. Though both these formulations were effective, the former was found to have a quicker knockdown action.

(vi) *Field rats.*—Intensive studies on the habits and control of these rodents were in progress at the Agricultural Research Station, Aduthurai. The commonest species occurring in the locality are (i) the grass rat (*Millardia meltada G*) and (ii) the mole rat (*Gunomys kok Gr*).

1. *The grass rat* (*Millardia meltada G*).—These are found in larger numbers during the seed-bed stage of rice. They live in shallow burrows excavated on the field bunds and more often in cracks and crevices, crab holes, etc. The entrance of their burrows is provided with a pad of grass covered over with a layer of earth. The damage caused by this species consists in clipping the seedlings in the nurseries and occasionally on the transplanted crops as well. Apart from rice, they also attack cotton and hoard the kapas inside their burrows. Recently they have also been noted to nibble the young sunhemp crop.

The mole rat (*Gunomys kok Gr*).—These rodents are highly destructive to most of the food crops like rice, Sorghum, ragi, tapioca, vegetables, etc., and in short, they seem to take to anything that is consumable. On rice, they infest the nurseries immediately after they are sown and feed on the seeds. They then recede into the background for a short period and the real damage commences from the shot-blade stage of the crop, the maximum havoc being wrought during the earhead stage. Considerable quantities of the earheads are cut and hoarded inside the burrows, the highest for a burrow being $5\frac{3}{4}$ lb. Their tunnels are tortuous and extensive, having a number of openings as well as blind ends. Invariably only one adult is found in each burrow. The breeding season synchronises with the availability of food. Initial multiplication starts by September–October with the maturity of the "Kuruvai" crop, and gets accelerated with the ripening of the Samba and Thaladi crops when there is a second brood. An idea of the prolificity can be had from the fact that a litter of 21 young ones was found in a single burrow. The main food of the adults appears to be grains, fruits and vegetables of sorts etc, but they also seem to be capable of thriving on bare roots of grasses during the off-season.

Comparative incidence of the two species at the nursery stage.—Observations were conducted on the relative incidence of the two species at the nurseries and the results assessed by recording the number of kills effected by a systematic baiting with Zinc phosphide. The trials were in progress from July to October and the maximum incidence was during August. Out of 681 rats found dead, 554 were *Millardia meltada* and only 127 of *Gunomys kok*. This affords enough evidence to presume that *Millardia* occurs in larger numbers during the nursery stage and that they have a better preference as well to the baits.

Field scale control.—Zinc phosphide mixed with popped rice was exposed regularly in the open as well as inside the burrows

for the whole season and the results compared with those of the mechanical methods of digging and catching and bow-trapping. In all, the poison bait was exposed in 18,529 places and only 1,024 of them were found disturbed. The total number of dead rats recovered was 289, 157 being *Gunomys kok* and 132 *Millardia*. As this method was obviously infructuous, the poisoned food was exposed inside the burrows of *Gunomys kok* and the results observed by digging out the colony the next day. Six hundred and ninety-eight burrows were thus treated. Of these, 400 were tenanted while the other 298 were empty. Among the tenanted burrows, only 182 rats (*Gunomys*) and 5 *Millardia* were found dead as a result of the poisoning and the occupants of the others were unaffected. As compared with the above, a total of 1,528 *Gunomys kok* consisting of 613 adults and 915 young ones and another 145 of *Millardia* (adults 108 and young 37) were caught and killed by the digging process. Besides these, 616 of *Gunomys kok* (220 adults and 396 young ones) and one of *Millardia* were dug out, caught and killed in the course of the observations connected with the baiting inside the burrows. Another 1,251 specimens consisting of 959 *Gunomys kok* and 292 *Millardia meltada* were also accounted for by the bow traps. A gist of the results of the different trials is furnished below: –

Control measures.	*Gunomys kok.*	*Millardia mettada.*	*Total.*
1 Poison baiting in nurseries ..	127	554	681
2 Poison baiting in transplanted fields.	157	132	289
3 Poison baiting inside burrows ..	182	5	187
4 Digging and catching (routine)..	1,528 (A—613 Y—915)	145 (A—108 Y—37)	1,673
5 Digging and catching while examining the results of baiting inside burrows.	616 (A—220 Y—396)	1	617
6 Bow traps	959	292	1,251
Grand total ..	3,569	1,129	4,698

NOTE.— A—Adult; Y—Young ones.

Economics.—

1. On an approximate estimate, the cost of killing a rat by poison baiting works out to 6 pies each. Though the cost is fairly low, the number of the rodents exterminated is not convincing and as such, the method is not complete by itself.

2. The digging and catching is generally left on a contract basis at rates varying from 1 to 1½ annas for every rat killed.

3. The setting up and working of the bow traps works out to one anna per rat inclusive of the labour charges.

From an overall review of the results obtained, it looks as if the control of the mole rat by poison baiting is capable of

considerable improvement. The grass rat—a comparatively harmless species—occurs in larger numbers at the seed-bed stage and shows a better preference to the baits. The diggings, though a laborious process, is perfect since every live rat, old or young, inside the burrow is accounted for. The bow trap also appears to be fairly effective though it requires some investment for the traps and daily attention, the other inevitable limitation being that only the adults which come out to feed or killed. The current year's plan of work has been reoriented with a view to improve the baiting technique. The entire area is prebaited with unpoisoned popped rice for about 4 or 5 days and the poison exposed on the next day separately in different media like popped rice and fried onions, popped rice, onions and fried fish, etc., etc. The idea behind exposing the baits in different vehicles is to study the preference, if any, exerted by the rats.

(*b*) *Pests of millets.*

(i) *The Sorghum ear head bug* (*Calocoris angustatus L*).—These bugs are more or less chronic on the irrigated Chitrai cholam crop round about Coimbatore. As desired by the Statistical Adviser to the Indian Council of Agricultural Research, a beginning was made to assess the loss in yield due to this pest.

The investigations had to be conducted at the Central Farm, Coimbatore, under certain limitations. Firstly, the infestation itself was more widespread than severe during the current year. Only three fields under the same strain (Co. 9) were available, but even these were sown on different dates. Control plots completely free from infestation could not be secured for comparison of the yields. As an alternative, portions of two infested fields were rendered pest-free by the application of BHC 5 per cent and the population and yields of these were compared.

The following procedure was adopted to estimate the pest population and the respective yields. The dusted and the non-dusted portions were divided into six blocks and each of these again sub divided into smaller plots of $2\frac{1}{2}$ cents with sufficient outskirts. One such plot was selected by randomization for each count from each block. In the selected plot, six four-foot square patches were marked out with a special frame. Four plants nearest to the corners of each of these squares were taken for the insect counts. The earheads of these 24 plants were shaken vigorously into separate glass jars and the entire bug population was thus dislodged. The adults and nymphs for each earhead were later counted separately and recorded. The yield data were calculated to an acre basis from 600 plants selected at the rate of 100 plants for each block, duly randomized. The data obtained gave an indication of the pest population and the

relative yields in the different fields under different conditions and a gist of the same is furnished below :

In field No. 45, the treated portion which showed an average population of 3·4 bugs per plant gave an yield of 1,891 lb. per acre. In contrast to this, the non-dusted portion with an initial population of 30·2 bugs per earhead yielded only 1319 lb. per acre. The calculated loss in yield per acre was, therefore, 572 lb. or 30 per cent and this figure was statistically significant (at P=0·01 level).

In field No. 74, the corresponding figures were 4·5 bugs per earhead and 1,577 lb. yield per acre for the treated plots and 23·2 bugs per earhead and 1,342 lb. per acre for the non-treated plot. The loss in yield was estimated as 15 per cent. These figures were, however, not significant statistically. With the data available, the loss in yield due to the pest is presumed to vary from 15—30 per cent as compared to protected fields. Weather data were collected during the course of the trials but no conclusions could be drawn on their influence on the pest.

The following interesting points were noted during the course of the experiments.

(1) The incidence of *Calocoris angustatus L.* reached its peak between the 12th and 14th of May this year when the age of the crop in the different fields varied from 66 to 80 days and that of the earheads from 14 to 20 days.

(2) The current year's experience shows that early sown crops are equally susceptible to the bug as the later sown ones.

(3) A reduvid bug *Reduviolus sp.*—was recorded for the first time as a natural enemy of Calocoris.

Insecticidal trials against Calocoris angustatus L.—Experiments conducted during the previous seasons have indicated that this bug could be controlled either by BH Cor DDT dusts, preference being given to the former because of its quicker knockdown effects, and lower cost. With a view to fix up the proper time of dusting, one treatment was given as soon as the earheads had come out in one set, followed by a second application at a later stage in another set of experiments. The results were compared with the normal dusting given during the period of peak incidence and the latter was found to be the best. It was also incidentally recorded that higher concentrations as well as repeated applications of BHC 5 per cent tend to suppress the yield while no such adverse effects were noted in the case of DDT. The experiments will be pursued.

(ii) *The Sorghum fly* (*Atherigona indica M*).—The life history, habits and control of this fly were investigated at the Agricultural Research Station, Siruguppa. The adults deposit their eggs on the leaves of the young seedlings. The maggots on hatching bore into the stem and cause the characteristic dead hearts. The seedlings are susceptible up to the fifth week after germination after which the pest recedes to the background. So far, the fly has not been found to breed on any alternative hosts.

Varietal susceptibility.—The incidence of the fly was carefully followed on four selected strains (Chittoor, Co. 7, As. 2095 and Madikattu) during the Mungari season but no information of interest could be gathered as the incidence was negligible, ranging from 4 to 8 per cent. The infestation reached its peak only in the Hingari season and observations were conducted on As. 2095, M. 47-3 and T. 1. The first mentioned variety was more susceptible than the others, the percentages of infestation being 76, 59 and 47, respectively.

Control measures.—The following experiments were conducted during the hingari season on two varieties, M. 47-3 and As. 2095, the latter being highly susceptible while the former is somewhat resistant.

(i) *Manurial trials.*—These were laid out with the following variants: (1) Groundnut cake at 60 lb. nitrogen level, farm yard manure at 20 cart-loads per acre, mixture of G.N.C. and ammonium sulphate 60 lb. and nitrogen and ammonium sulphate alone at 60 lb. nitrogen level. The infestation of the fly was recorded at weekly intervals from the germination up to the fourth week stage of the crop. The plots were harvested and the yield data gathered separately. The details are furnished below:—

Treatments.	*Acre yields in pounds.*				*Percentage of attacked seedlings—Mean for 4 replications.*	
	M. 47-3.		*As.* 2095.		M. 47-3.	*As.* 2095.
	Grain.	*Straw.*	*Grain.*	*Straw.*		
1 Groundnut cake at 60 N. level.	1,341	3,190	854	2,397	60	75
2 Farmyard manure, 20 cart-loads.	1,573	3,272	1,051	2,167	62	78
3 Mixture — Groundnut cake and ammonium sulphate at 60 N. level.	1,159	2,705	957	1,741	61	77
4 Ammonium sulphate at 60 N. level.	1,141	2,749	600	1,792	61	76
5 Control. (No manure.)	1,219	3,056	826	2,067	51	77
General mean	1,287	2,994	855	2,033	59	77
Significance by F. test.	N.S.	N.S.	Significant.	N.S.	N.S.	N.S.
Standard error ..	198·7	309·7	26·03	231·8	23·5	2·77
Critical difference at 5 per cent level ..	..	..	253·6	..	..	..
Conclusions			2, 3, 1, 5, 4.			

It may be seen from the above data that in the case of As. 2095, the treatments with farmyard manure gave significantly higher grain yields while the results of the others were not significant. There was no appreciable difference in the percentages of infestation among the various treatments. But between the two

varieties, the average infestation in M. 47-3 was only 59 per cent as against 77 per cent in the case of As. 2095 which confirms the higher susceptibility of the latter.

(ii) *Flooding.*—Seedlings which were about 10 days old were submerged under water for periods varying from 10, 20 and 30 minutes with and without the addition of fish oil rosin soap. The progressive infestation was recorded at weekly intervals as in the above case. The data gathered are presented below:—

Treatments.	*Acre yields in pounds.*				*Percentage of attacked seedling.—mean for 4 replications.*	
	M. 473.		*As.* 2095.		M.47-3	*As.*2095
	Grain.	*Straw.*	*Grain.*	*Straw.*		
1 Control	181	2,444	176	2,271	68	70
2 Flooding for 10 mins. ..	189	2,272	137	2,708	53	57
3 Flooding for 20 mins. ..	207	2,236	111	2,515	54	73
4 Flooding for 30 mins. ..	167	1,276	104	1,999	68	72
5 Flooding for 10 mins with Fish oil rosin soap	200	2,438	183	1,932	63	69
General mean	189	2,133	142	2,285	61	68
Significance by F test ..	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
Standard error ..	437·5	434·1	415·9	454·5	6·38	6·68

There were no striking variations in the incidence of the fly or in the yield amongst the various treatments in each variety.

(iii) *Spraying.*—Sprays of BHC and DDT were applied at 0·05 and 0·1 percent at intervals of 10 days, commencing from germination up to the fourth week stage of the crop. The treatments were repeated once, twice and thrice in separate sets of plots. Counte of progressive infestation showed 19 and 24 per cent under BHC and 65 and 67 per cent under DDT as against 65 per cent in the controls. There was no appreciable difference amongst the various rounds of the treatments themselves. The figures are furnished below:—

Treatments.	*Percentage of attacked seedlings—Mean for 4 replications.*
1 DDT 0·10 per cent	65
2 DDT 0·05 do.	67
3 BHC 0·10 do.	19
4 BHC 0·05 do.	24
5 Control	65

(iv) *Drilling.*—BHC and DDT as dusts at 5 per cent were drilled along with the seeds (As. 2095, M. 47-3. T. 1) and the progressive infestation of the fly recorded. There was no significant difference in the infestation in the treated lots as compared

with that of controls, the percentage of infestation ranging from 40 to 51 in the case of BHC 5 per cent, 52 to 64 in the case of DDT 5 per cent as against 51 to 67 in the controls.

(c) Pests of vegetables.

(i) *Cutworms on snakegourd seedlings* (*Agrotis ypsilon R and Prodenia litura F*).—A report of damage by cutworms to snakegourd seedlings was a novel experience by itself for Coimbatore. These worms hide during day time under clods, crevices, wild vegetation, etc., and invade the fields during nights, and cut the seedlings at ground level. The opportunity was availed of to conduct some preliminary trials with DDT and BHC against the pests. The dusts were applied at 5 per cent to the soil in and around the pits late in the evenings, taking care to see that the chemicals did not come in contact with the plants as they are likely to scorch them. The pits were examined the next morning and numbers of the dead caterpillars were recovered from those treated with BHC. A fairly large area of this vegetable grown on a commercial scale was effectively saved by the timely action.

(ii) *The sweet potato weevil* (*Cylas formicarius Fb*).—This is the major pest of sweet potato which occurs both in the field as well as on the harvested tubers. In the field, the infestation is heavier on the vines than on the tubers. Tubers of deep rooted varieties generally ward off the weevil. The variety 'Triumph' appears to be the most susceptible and Nos. 29 and 33 were fairly resistant. Further observations are being made on this aspect.

Vines, having the insects inside were subjected to fumigation with Chlorosol, Calcium cyanide and BHC dust 5 per cent at the usual dosages for varying periods ranging from 8 to 24 hours with a view to eliminate the borers and plant only the pest free cuttings. All the treatmonts showed a tendency to cause more harm to the vines than to the pests themselves. The problem, therefore, awaits further solution.

(iii) *The potato tuber moth* (*Gnorimoschema operculella Z*).—Insecticidal trials were started both in the field and the godowns at the Agricultural Research Station, Nanjanad. BHC 0·05 per cent spray and 4 per cent dust and DDT 0·1 per cent spray and 5 per cent dust were the variants tried in the field. In all, three triweekly treatments were given during November—December 1950. Counts of infestation by the borer did not give any convincing results at harvest mostly due to the low incidence of the pest.

DDT 3 per cent was applied to seed potatoes in the godowns to test its efficacy in checking the infestation. Random counts before and after treatment did not show any convincing variations.

(iv) *The Bhendai jassid* (*Empoasca devastens D*).—A small scale trial conducted at the Millet Breeding Station confirmed the high

efficacy of DDT 0·05 per cent against both the adults and nymphs, the reduction in population being 97 and 92 per cent respectively. Nifos–T at 0·1 per cent compared favourably with DDT, the corresponding figures being 92 and 97 per cent against the adults and nymphs.

(v) *The Green leaf caterpillar of lablab* (*Azazia rubricans B*).—Two preliminary trials were conducted with BHC and DDT in the form of dusts at 5 per cent as well as sprays at 0·1 and 0·05 per cent against these caterpillars. Observations have indicated the high efficacy of BHC 5 per cent dust and 0·1 per cent sprays. Caterpillars, both young and grown up, began to drop down and die within half an hour after treatment.

(*d*) *Pests of fruits.*

(i) *The Orange borer*—(*Chelidonium einctum G*).—Refer "Review of work done under special schemes".

(ii) *The fruit moths* (*Othreis spp*)—Insecticidal trials against these moths were in progress at Cuddapah during September-October 1950. Adults of both species, *Othreis fullonica L* and *Othreis materna. L* were prevalent in this area, but the former predominated in numbers. The moths visit the gardens during nights when the fruits are ripe, pierce them with their long proboscis and cause the subsequent dropping of the fruit.

Two gardens were selected and three rounds each of BHC and DDT sprays at 0·05 and 0·1 per cent were applied separately at intervals of seventeen days to six trees in each garden. The results were assessed by counting the dropped fruits between two treatments. In the first set of trials, the aggregate number of such fruits for the six trees was 1, 3, 23 and 29 respectively in the case of DDT 0·1 per cent, DDT 0·05 per cent, BHC 0·1per cent and BHC 0·05 per cent as compared to 32 in the control. The corresponding figures for the second garden were 5, 6, 25, 23 and 51 respectively. The results indicate the efficacy of DDT 0·1 per cent. BHC sprays at both the concentrations were found to impart trace of its odour to the fruits.

(iii) *The Ber fruit borers* (*Carpomyia vesuviana B and Meridarchis scyrodes M*).—Insecticidal treatments with BHC and DDT had given indicative results against these borers during 1949–50. Confirmatory tests with proper lay outs were undertaken during this year with two variants, BHC 0·05 per cent and DDT 0·1 per cent having fifty trees under each treatment. The spraying operations were commenced from 14th September 1950 when the fruits had set and developed and repeated at triweekly intervals. They were discontinued a month prior to harvest, the total number of sprays given for the season being four. The progress of infestation was assessed by collecting 300 fruits at random between two sprays for each treatment and examining them separately for the two borer pests. The fly being the major factor in this

locality, the results obtained against this pest only are discussed below. The infestation in the DDT. plots which amounted to 20·7 per cent in the initial count, showed a downward trend to 19·3 per cent and 16·3 in the next two examinations as compared to 68 per cent, 77 per cent and 74·3 per cent in the controls. The percentages in the BHC plots were 8·7, 13·0 and 16·7 while they were 69·0, 74·3 and 72, respectively in the controls.

The yield was computed by recording the total weight of the fruits harvested from five trees of the same variety, selected at random for each of the treatments. The average yield per tree was 159½ lb. for DDT, 142½ lb. for BHC and 90 lb. and 74½ lb. for their respective controls. Besides the additional yield of 68 lb. for BHC and 70 lb for DDT, the more important aspect to be considered is the greater percentage of borer-free fruits borne by the sprayed trees. The weight of the produce was also inversely proportionate to the infestation. The gross infestation by *Carpomyia vesuviana* and the caterpillar *Meridarchis scyrodes* in the DDT lot was 24·9 per cent (*Carpomyia vesuviana* 18·8 per cent and *Meridarchis scyrodes* 6·1 per cent) and the yield was 77 per cent over control. The figures for BHC are 17·3 per cent gross infestation (*Carpomyia vesuviana* 12·8 per cent and *Meridarchis scyrodes* 4 5 per cent) and 92 per cent increase yield over the control.

The treatments proved to be highly profitable from the economic point of view also. The average cost of four rounds of the treatments worked out to Rs. 1–3 0 in the case of BHC and As. 13 for DDT including labour charges. The additional yield more than compensated the trouble as the net profit in terms of money value exceeded Rs. 10 per tree in both the treatments. Between the two chemicals, DDT is preferred since BHC, apart from its higher cost, has been found to impart a trace of its odour to the fruits.

(iv) *The Sapota leaf-webber* (*Nephopteryx eugraphylla R*).—The damage by this leaf-webber was fairly widespread in the College Orchard during the year. BHC and DDT sprays were applied at 0·1 per cent and the results observed. Sample counts showed that BHC caused a mortality of 56 per cent of the caterpillars as against 33 per cent for DDT. Field observations also supported these findings since the ground under the trees treated with BHC was literally strewn with the dead larvae.

(v) *The pomegranate fruit borer* (*Virachola isocrates F*).—Insecticidal trials were undertaken against this borer on a small scale to see whether the chemicals exerted any deterrent or lethal action. BHC and DDT sprays were applied at 0·1 per cent at intervals of 21 days. The results are not very encouraging in spite of the fact that the percentage of non-infested fruits was at its maximum in the case of BHC (54 per cent) as compared to 46 per cent and 37 per cent in DDT and control, respectively.

(vi) *The San jose scale* (*Quadraspidiotus perniciosus C*).—The effects of diesel oil emulsion as a protective dormant winter spray against this troublesome scale were studied at the Pomological Station, Coonor. Plants treated during December 1949 were found to withstand further attack till November 1950 when a few fresh swarming nymphs were noted for the first time. The non-sprayed plants, on the other hand, were infested, throughout the season. In January 1951, the dormant spray (6 per cent diesel oil emulsion) for the year was given for about 701 plants of peaches, plums, pears and apples and the results are being watched. The sprayed plants have not shown any fresh infestation till the end of June 1951, whereas the non-treated plants are affected.

(vii) *Fruit flies on plums* (*Chaetoodacus sp.*).—Experiments were initiated at the Pomological Station, Coonoor, to assess the repellent and the probable lethal actions of BHC and DDT on fruit flies on plums. Two sprays of BHC 0·05 per cent and DDT 0·1 per cent were applied during March and April 1951 to an equal number of trees with appropriate controls. Counts of the infested fruits were taken before and after treatment. Since the general incidence of the fly was very low, no conclusive results could be obtained.

(e). *Pests of Oilseeds.*

1. Coconut.

(i) *The black-headed caterpillar—Nephantis serinopa M.*—This is probably the most serious enemy of this palm. Its incidence is being kept under check by the breeding and colonization of its natural enemies—the Eulophid, the Bethylid and the Braconid (see Biological control).

Insecticidal trials.—The possibility of a quick control of these caterpillars infesting small trees by insecticidal methods was investigated. DDT sprays ranging from 0·05 to 0·2 per cent and BHC 0·05 and 0·1 per cent were applied and the last mentioned caused 92—100 per cent mortality in the course of 72 hours, while the effects of DDT were feeble.

(ii) *The Rhinocerôs beetle—Oryctes rhinoceros L.*—This beetle is another major pest of the coconut palm. The control of the adults is fairly easy as they can be systematically hooked out from the trees but that of the grubs which breed in their hundreds in manure pits is still a problem. Different formulations of DDT and BHC applied on a laboratory scale have given little or no indication of relief and the work will have to be continued for some time.

2. Castor.

The castor crop at the Central Farm was infested by a series of pests from its very start. At the early stages, *Laphygma exigua Hb* and *Prodenia litura F* threatened to defoliate the plants.

Later *Ergolis merione Cr.*, *Euproctis* sp., *Parasa lepida* G and *Achoea janata* L appeared on the grown-up plants. The developing fruits and shoots were infested by *Dichocrocis punctiferalis* G. The mite—*Tetranychus telarius* L—was bad all over the plots, the attack being more intense in localized patches.

Field trials were conducted with DDT and BHC as dusts at 5 per cent and as sprays at 0·1, 0·05 and 0·025 per cent against these pests as they occurred. DDT had a salutary effect against Prodenia and Laphygma while BHC exerted little or no control, the infested fields being completely grazed away necessitating a resowing.

(i) *The castor semi-looper—Achoea janata* L.—Extensive trials were in progress with a number of chemicals as sprays and dusts in various concentrations. BHC, DDT, Pyrodust, Agrocide cotton dust, Hexidol G. 205 P, 810 L, Calcium arsenate, Thevetia extract and Pyrocolloid were the variants. Of these, only BHC 10 per cent and Agrocide cotton dust were effective against the young caterpillars, while BHC spray at 0·1 percent caused an appreciable mortality of the grown-up ones. From the tests conducted so far, it looks as if the insecticidal treatments are worth the trouble only when the caterpillars are young and for the advanced stages only a systematic hand-picking appears to be cheaper and thorough, giving an immediate relief

(ii) *The castor pod borer— Dichocrosis punctiferalis G.*—Plants with insect-free bunches were selected and the two synthetic insecticides applied as dusts at 5 per cent and as sprays at 0·1, 0·05 and 0·025 per cent concentrations at fortnightly intervals. The progressive infestation was noted in the different treatments. The percentage of bored capsules varied from 6 to 7 in the treated lots while it was 18 in the controls. All the applications were effective. These trials will be pursued during the ensuing season for confirming the results.

(iii) *The castor mite—Tetranychus telarius* L.—These mites are preyed upon by the adults and grubs of the Staphylinid—*Oligota flaviceps*—and by a species of thrips *Scolothrips sexmaculatus P.* but the activities of these predators were prominent only after the pest itself had developed to virulent proportions. Application of BHC and DDT sprays at 0·025 and dusts at 5 per cent showed that BHC killed the pest as well as its predators, while DDT had a specific action against the latter and practically inert against the mites. This is probably the main reason for the unrestricted multiplication of this Arachnid in the DDT plots. Parathion spray at 0·025 per cent and HETP at 0·1 per cent were also found to cause 98—100 per cent mortality of the mites.

3. Groundnut.

The Red hairy caterpilar (*Amsacta albistriga Moor*). Extensive field and laboratory trials were conducted against this endemic pest of groundnuts. The variants were sprays of BHC 0·05

per cent MKE 1 oz. in 1 gallon, Pyrocolloid 1 in 600 pure and with BHC 0·05, BHC 0·05 per cent plus 1 oz. of MKE in 1 gallon, BHC 10 per cent dust and Agrocide cotton dust. Of these BHC 10 per cent and Agrocide cotton dust, BHC 0·1 per cent and Pyrocolloid 1 in 600 plus BHC 0·05 per cent. spray were found effective. Further trials are necessary to confirm the results.

(*f*) *Pests of Fibre crops.*

(i) The Cotton boll-worms (*Earias and Platyedra*).—(See Biological control).

(ii) *The Cotton Jassid* (*Empoasca devastens D*).—Experiments were conducted to confirm the previous findings regarding the effects of BHC and DDT on this jassid. The variants were dusts of DDT at 1, 3 and 5 per cent, BHC 5 per cent and sprays of the two chemicals at 0·05 per cent. The specific action of DDT was indicated, the spray causing over 90 per cent reduction both in the case of adults and nymphs while that of BHC was only 50 per cent on the nymphs only.

(iii) *The cotton thrips* (*Thrips tabaci L*).—The formulations tried against the cotton Jassid were experimented with in the case of the thrips also and the action of the two chemicals was more or less equal in efficacy.

(*g*) *Pests of green-manure crops* (*Sunhemp and Daincha*).

Some of the common pests like *Semiothesa pervolgata Wlk Utethesia pulchella L*, etc., occurred in a mild form round about Central farm and they were found amenable to control by BHC.

B. Insecticidal trials.

Besides conducting detailed investigations on the control of major pests, referred to under the particular crops, a number of miscellaneous items received attention as and when opportunities occurred.

1. *Aleurodids on castor* (*Trialeurodes ricini M*).—DDT and BHC as dusts at 5 per cent and sprays at 0·2, 0·1 and 0·05 per cent were applied against these insects on castor seedlings. The BHC formulations proved more effective, the mortality ranging from 70–84 per cent as against 35–50 per cent for DDT.

2. *Pod bugs on lab-lab* (*Clavigrella horrens D*).—DDT and BHC as dusts, Agrocide cotton dust and pyrodust were tried against this bug. Counts of the insects on 50 pods taken at random, both before and after the experiments, revealed the remarkable effect of BHC and Agrocide cotton dust, both causing about 100 per cent reduction of population during the course of 24 hours.

3. *Psyllids on curry leaf* (*Diaphorina citri K*).—Laboratory trials showed that BHC 5 per cent dust is capable of causing about 100 per cent mortality of both the adults and nymphs, whereas DDT 5 per cent was effective only against nymphs.

4. *The brinjal Epilachna* (*Epilachna sp.*) —Both adults and grubs were subjected to various chemicals in the laboratory to assess their relative susceptibility. The mortality of the adults and grubs was cent per cent in the case of DDT, H.E.T.P. and Parathion sprays at 0·1 per cent and Toxophene dust 20 per cent.

5. *Control of fly maggots Musca sp., Stomoxys sp., etc.*— Experiments were initiated with BHC and DDT at the Insectary, the idea being to adapt the chemicals if they were found successful for large scale treatment of cattle manure. The dusts and sprays were applied in varying strengths to cowdung both fresh and dry stored in pots, with rotten fish as the bait for the flies. The pots were kept open for a day for the natural oviposition by the adults and covered by nets from the next day onwards. The efficacy of the insecticides was assessed by counting the number of flies which emerged subsequently form the respective pots. No conclusive results were available even though the emergence of flies was the minimum in the case of BHC 0·1 per cent spray.

6. *The melon fruit fly* (*Dacus cucurbitæ Cog.*).—Laboratory trials on the contact action of BHC and DDT on this fly were conducted. Cylindrical jars were sprayed with sugar solution mixed with the chemicals at 0·1 per cent with the help of an atomiser and allowed to dry. The control jars were sprayed with mere sugar solution. A definite number of flies were allowed to emerge in the jars. The captives in the BHC receptacles were found to die within half an hour, while it took about 4 hours for the DDT lots. The overall mortality was 100 per cent in the case of BHC as against 71 per cent for DDT.

7. *Poison baiting against the paddy grasshopper* (*Hieroglyphus banian F*).—Laboratory trials on poison baiting were continued at Coimbatore against this grasshopper. Sodium fluosilicate and BHC 5 per cent dusts were the two poisons used with bran forming the the bulk material. The hoppers were generally indifferent to the baits as they fed on them more by accident. The addition of attractants like amyl acetate, orange oil, etc., to the baits did not improve the efficacy,

C. Aphids and Coccids.

These forms belong to the group of sucking insects and are a serious menace to most cultivated crops and plants and the present methods of control cannot yet be claimed to be perfect. Considerable time was spent in investigating some of these pests and the following is a gist of the results.

Aphids.

Tobacco decoction is the approved specific against these bugs but it has certain disavantages like its high cost, the laborious

method of preparation and low keeping qualities. Some of the recent chemicals were tried against this group occurring on various host plants with a view to find out a suitable substitute.

1. *Aphids on cowpea* (*Aphis Sp.*).—Sprays of Nifos-T 0·1 per cent, HETP 0·1 per cent and BHC 0·1 per cent compared favourably with tobacco decoction, the percentage of mortality in the respective cases being 75, 75, 80 and 100 per cent during the course of 72 hours.

2. *Aphids on lab-lab* (*Aphis medicagenis K*).—Nifos-T and HETP proved very efficacious in the case of this species also. The percentage of reduction in both the cases was as high as 100 per cent. The alternatives,-Pyrocolloid, BHC and DDT sprays gave 88, 96, and nil per cent reduction.

3. *Aphids on Glyricidia* (*Aphis Sp.*). -Parathion, Nifos-T, BHC and DDT 0·1 per cent concentrations were tried in this case. Cent per cent kill was recorded with the first three chemicals as against 35 per cent for DDT.

4. *Aphids on agathi* (*Aphis Sp.*).—This species also was found easily susceptible to all these chemicals. Nifos-T and Parathion sprays at 0·05 per cent and 0·1 per cent, BHC 5 per cent dust, and spray 0·05 per cent and DDT sprays at 0·1 and 0·2 per cent gave 100 per cent mortality within 48 hours. Pyrocolloid was not so highly lethal.

Coccids.

The control of these scales and mealy bugs has for a long time been a problem. Even though fish oil resin soap and crude oil emulsion are advocated against them, the former is effective only to a certain degree and that too after repeated applications while the latter often scorches the plants, if used carelessly. Laboratory and field trials were conducted against a few species with the recent chemicals such as BHC, DDT, MKE emulsion ; HETP, Parathion, Pyrocolloid, Nifos T-Chlordane, etc. The following represents a gist of the findings :—

(1) *The purple scale* (*Lepidosaphes becki N*).—Parathion 0·025 per cent and DDT-MKE emulsion 0·16 and 0·32 per cent gave indicative results but the experiments have to be continued for a more accurate assessment of the insecticidal properties. (Refer Orange Borer Scheme, I.C.A.R.)

(2) *The black scale* (*Saissetia nigra N on crotons*).— Two sets of field trials were conducted against this pest. A comparative analysis of the data shows that Parathion 0·025 per cent was most effective giving 79 per cent kill as against 58 per cent, 52 per cent and 41 per cent for MKE emulsion 0·16 per cent, BHC 0·1 per cent and HETP 0·2 per cent respectively.

(3) *Aspidoproctus Sp. on Thevetia.*—Parathion 0·025 per cent gave encouraging results in the case of this scale also. The

relevant average mortality figures after a week may be summarised as 63 per cent, 35 per cent, 12 per cent, 6 per cent and nil for Parathion, MKE emulsion, BHC, DDT, and control, respectively.

(4) *Mealy bugs on crotons* (*Pseudococcus virgatus C*).—Nifos-T was found to be the most effective causing a reduction in population to the extent of 96 per cent, the other chemicals in the order of merit being MKE emulsion (92 per cent), BHC (91 per cent) and FORS (78 per cent).

Among the other Coccids under study were scales on Sapota (*Lecanium Sp.*) and Tapioca (*Lepidosaphes Sp.*) and mealy bugs on Antigonon and Gooseberry (*Pseudococcus Sp.*). The results obtained are more indicative and trials have to be continued until definite results are obtained.

D. Contact, stomach and residual action of DDT and BHC.

These experiments were continued on a more elaborate scale than last year. Filter papers dipped in 0·1 per cent and 0·05 per cent suspensions of BHC and DDT were kept moist as well as dry and caterpillars (*Prodenia*) of uniform age were allowed to come in contact with them for periods varying from 5 to 60 minutes. The results indicate that the mortality increases with the period of contact and that the one-hour period caused a kill varying from 60 to 80 per cent in DDT 0·1 per cent, 70 to 100 per cent in BHC 0·1 per pent, 40 to 80 per cent in the case of DDT 0·05 per cent and 60 to 90 per cent in the case of BHC 0·05 per cent. The 0·1 per cent suspensions of the same chemicals were applied to leaves and fed to caterpillars by the sandwich method. The mortality was 80 to 100 per cent in the case of BHC and 70 to 90 per cent in the case of DDT. In another set of trials, filter papers dipped in 0·1 per cent suspensions of the chemicals were dried both in the shade as well as in the sun for periods ranging 1 to 10 days and caterpillars allowed to come in contact for a period of two hours in each case. Except for the fact that the mortality was higher in the case of the papers dried for shorter periods of one and two days, the results of the other cases were inconclusive.

E. Adverse effects of BHC and DDT.

Apart from testing the lethal action of these chemicals against a variety of pests, attention was also devoted to the adverse effects attendant on their use. Interesting data have been gathered on such phenomena like secondary infestation by mites and aphids, phytotoxic effects especially on cucurbits, effects on edible qualities, etc. The following is a short resume of the work done :—

(i) *Mites on castor* (*Tetranychus telarius L*).—DDT and BHC dusts at 2 and 5 per cent and sprays at 0·2, 0·1 and 0·05 per cent were applied at weekly intervals on plants previously rendered free of insects and mites with appropriate

controls. Ten rounds of treatments were, in all, given between July and September. An appreciable incidence of mites was noticed in the DDT lots during the course of three to four weeks. Subsequent applications of the chemicals had no effect but the few Staphylinid grubs *Oligota flaviceps* which are predaceous on the mites were killed. It is surmised that the latter phenomenon has been responsible for the unrestricted multiplication of these creatures. BHC on the other hand, killed both the predator as well as the host.

(ii) *Mites on brinjal and bhendi* (*Tetranychus telarius L*).—Brinjal and bhendi plants, treated with BHC and DDT sprays at 0·1 and 0·05 per cent at fortnightly intervals were kept under observation from September to November. Here also it was found that the mites multiplied to enormous proportions on both the crops treated with DDT, but were practically absent in the BHC treatments.

Incidently, the selective action of the chemicals also was confirmed. The brinjal and bhendi plants treated with DDT were free from the Jassid (*Empoasca devastens D*) and the Coccinellid (*Epilachna Sp.*) while BHC was not of much use against these pests.

(iii) *DDT and BHC against aphids and their predators.*—It has also been recorded that the application of DDT is often followed by an attack of Aphids as well. Investigations on the causes showed that they were similar to those on mites. Aphids are usually preyed upon by the larvae of an Agromyzid, a Syrphid and a Coccinellid. Laboratory trials showed that DDT caused a kill of 40 to 50 per cent of aphids 30 to 40 per cent of the Agromyzid maggots, 10 to 20 per cent of the Syrphid and 80 to 100 per cent of the lady-bird grubs. BHC, either as dust or spray, caused a complete kill of the host as well as the predators.

2. *Phytocidal action*—(*a*) *Cucurbits.*—Five species of cucurbits, Snakegourd (*Trichosanthes anguina L*), Bottle gourd (*Lagenaria vulgaris ser*), Cucumber (*Cuccumis sativus Lem*) Ribbed gourd (*Luffa acutangula Rox*) and Bitter gourd (*Momo dica carantia Lin*) were subjected to BHC and DDT as dusts at 5 per cent and sprays at 0·1 per cent and 0·05 per cent at fortnightly intervals in three separate sets of trials. Bottle gourd and cucumber were found to be exceedingly sensitive to BHC, the 0·1 per cent concentration causing wilting in two to three days and death of the plants in another four to five days in the case of Bottle gourd only. Cucumber showed signs of wilting more slowly at the above concentration but a complete death was noted generally after a second treatment. The 0·05 per cent spray and the dust had a similar action though it was somewhat delayed and the death of the plants occured after the second application here also. In the case of Snake and Bitter gourds, the above spray fluids caused a stunted growth and poor development of the plants, but no

complete kill was effected. The interesting finding is that Ribbed gourd withstood even three rounds of the chemicals without exhibiting any of the adverse effects. As regards, DDT, the adverse effects were of a milder nature causing only a gradual yellowing and general suppression of growth and that too only after eight days, Bottle-gourd and Cucumber being the worst sufferers *also.* The usual infestation by mites occurred on Cucumber, which has probably been the cause of the death of the plants. Ribbed gourd was unaffected in this case also. Two other sets of trials with pumpkin (*Cucurbita pepo*) and Ash gourd (*Benincasa cerifera*) showed that BHC was phytotoxic and that DDT brought about infestation of mites in the case of the latter while pumpkin was not affected at all.

A scrutiny of the temperature, humidity and rainfall data of the different periods during which the trials were in progress shows that the scorching effects were more severe under higher temperatures and that rains received a day or two after the treatments do not save the plants.

3. *Effects on other plants.*—Adverse effects were also noticeable in the case of brinjal and bhendi sprayed with the chemicals at 0·1 and 0·05 per cent. The general growth was retared by BHC, while DDT had a temporary stimulative action on both the crops. But the subsequent infestation by mites in the DDT lots suppressed their normal development. The yields were proportionate to the vigour of the plants.

The chemicals were tried as sprays and dusts at 5 per cent on chillies, sweet potato, cowpea, greengram, onions, and tapioca. Only the last mentioned showed a mottling of the leaves in the case of BHC. The others were quite normal.

4. *Effects on edible qualities.*—A cursory assessment of the influence of these treatments on the edible qualities of the products was also made. Brinjal, bhendi and house-beans showed traces of the smell of BHC on cooking. An application of four rounds of the chemical (BHC) practically ruined the flavour of onions, there being a distinctive earthy smell in the bulbs on cooking. Repeated applications of BHC spray 0·05 per cent are also reported to leave a trace of the odur on orange and Ber fruits. In the case of plums, the undesirable effects were, however, not so pronounced.

F. Viability of seeds.

With a variety of seed material DDT and BHC dust 5 per cent were separately mixed at the rate of 1 lb. of the chemicals for every 100 lb. and kept for an year. Periodical tests regarding their viability as well as their susceptibility to insect infestation were conducted and the indications were that their germinating capacity was not affected. As the evidence regarding their immunity from insect damage was not conclusive, the experiments were commenced again and are in progress for the past four months. The

samples of seeds consist of paddy, cholam, gingelly, groundnut, cotton, bengalgram, redgram and pillipesara. The seeds were treated as in the previous case and a definite number of the different specific pests like *Sitophilus Sp. Rhizopertha Sp. Corcyra Sp. Tribolium Sp.* and *Bruchids* were introduced separately into the treated and control bags and their progress watched. The general findings are that all the insects introduced in the treated lots died without even laying eggs while they throve normally in the controls. Coming to the details of the mortality, Bruchids died within 2 to 4 days, Calandra and Rhizopertha in 3 to 4 days and Tribolium in 4 to 5 days in the DDT lot during the first two months. The effects of BHC were similar, except in the case of Tribolium which took 6 to 7 days to die. There were also indications of the slower mortality of all the species in the case of BHC during the third month of the observations the probable reason being a deterioration in the residual effects of the chemical. Certain variations were also recorded in the mortality of the same species, when allowed to come in contact with different grains treated with the same insecticide and the probable reason for this is surmised to be the variations in the quantity of the insecticides retained by the different materials. It is likely that the nature of the seed coat may have some influence on this aspect. The experiments have been in progress for four months and no deleterious influence has been recorded in the germinating capacity of all the seeds.

G. Effect of fumigation with Calcium Cyanide on oil seeds.

Four different oil seed material viz., castor, gingelly, groundnut and cotton were fumigated with calcium cyanide to the rate of 4 lb. per 1,000 c.ft. and the seeds kept under observation. Samples were drawn every month and sent to the Government Agricultural Chemist for analysis of the H.C.N. contents and the results of the three months' progress are furnished below :—

Seed material.	*Date of fumigation.*	*Results of analysis—Residual HCN. %*		
		March.	*April.*	*May.*
(1)	(2)	(3)	(4)	(5)
Castor seed	2nd March 51	0·0014	0·0028	0·0028
Gingelly	2nd March 51	Nil.	0·0011	0·0019
Groundnut	2nd March 51	0·00057	0·0013	0·0018
Cotton	2nd March 51	0·0014	0·0022	0·0011

H. Biological control.

The following constitute the items investigated under this category :—

(i) *Control of the fluted scale—Icerya purchasi M with Rodolia Cardinalis Muls.*—(Refer review of work done under schemes.)

(ii) *The black headed caterpillar of coconut (Nephantis serinopa M).*—Large scale multiplication of the three specific parasites, *Persierola nephantides M*, *Bracon brevicornis W* and *Trichospilus pupivora F.* was continued and consignments of these were despatched to different localities for liberation In all, about 7,000 Eulophids, 400 Bethylids and 1,300 Braconids were distributed.

(iii) *Utilization of the egg parasite—Trichogramma minutum R.*—Mass rearing of Corcyra as well as Trichogramma was in progress. Besides supplying the necessary stock for the investigations in progress in the Section, large quantities of Corcyra eggs as well as the parasitised egg-cards were supplied to the Sugar Factory, Nellikuppam, Crop Protection Officer, Ahmednagar, the Sugarcane Specialist, Anakapalli and the Central Sugarcane Research Station, Coimbatore.

(*a*) *The Cholam stem-borer (Chilo zonellus S)*—Laboratory studies had indicated that the Chalcid, Trichogramma is capable of parasitising the eggs of this borer to as high a degree as 85 per cent. With these encouraging findings, attempts were made on a field scale to adopt the biological methods of control against this borer on both the rainfed and irrigated crops. The parasites were colonized in two one-acre blocks at the rate of 20,000 per acre per release with appropriate controls. The releases were commenced by September on the rainfed crop when it was about a month old and continued at weekly intervals up to November, there being in all 14 liberations. Counts of the dead hearts were recorded on a 3 per cent basis twice a month. The results obtained are more indicative, since the infestation ranged from 8·5 to 31·5 per cent in the colonized plots as against 9 to 41 per cent in the controls. Similar results were obtained for the irrigated cholam also. The colonization was started in March 1951 and continued up to May there being altogether 7 weekly releases. The percentage of infestation ranged from 3·0 to 20·5 for the colonized plots and 8·6 to 47·0 for the controls.

(*b*) *The cotton bollworms—Platyedra gossypiella S and Earias fabia S and Earias insulana B.*—Biological control of these borers with Trichogramma was first attempted by the Section during 1941 and the results have shown that colonization of this parasite brings about a reduction in infestation appreciably during February-March. The experiments were, therefore, continued during November 1950 to confirm the previous results. Liberations of the parasites were made at the rate of 20,000 per acre per week from 12th November 1950 onwards in two one-acre blocks with appropriate controls. Sixteen releases were made from the time of flowering till the bolls were almost mature. The incidence of bollworms subsequent to the releases was assessed by periodical examination of 200 flowers collected at random during earlier stages and of 500 bolls after they had burst open. The average of five post-liberation counts made during the fruiting stage has given

an infestation percentage of 7·9 for the colonized plots as against 11·8 for the controls. The corresponding figures for the mature crop are 10·9 per cent for the colonized plots and 20·1 per cent for the controls.

(iv) *The apple woolly aphis* (*Eriosoma lanigera H*).—The general incidence of the pest on apple, at the Pomological Station Coonoor, was scarce during July–October 1950, nil during November 1950–February 1951 but there were stray revivals during March–June 1951. The reduction is mostly due to the reported replacement of the existing stocks with the Aphis resistant varieties and to a certain extent to the assiduous colonization of the specific parasites *Aphelinus mali Hal.*

(v) *Influence of parasites and predators on aphids.* Aphids are kept under check in nature by a few natural enemies. Preliminary observations on the actual number of aphids consumed by the different predators were conducted. Of the three species, commonly found feeding on aphids, adults of the Coccinellid *Chilomenes sexmaculata F* were found to consume about 20 specimens per day and their grubs about 19. The Syrphid maggot (*Syrphus balteatus dely*), on the other hand, was found to prey on 18 specimens per day.

I. Bee-keeping.

This branch of activity of the section continued to attract the usual degree of public interest and the lines of research conducted during the period under report consist of a few long-range problems which, if successfully concluded, are likely to improve the status of this industry as an economic proposition.

General.—An average strength of 32 colonies was maintained more or less exclusively for purposes of research. Consequent to the more favourable weather and pasturage conditions prevalent during the year, as compared with the previous one, the progress and performance of the bees were slightly better, though they were in no way near normal. A total quantity of 87 lb. with an individual average of 7 lb. 10 oz. was available from the colonies in yielding condition as against 39 lb. (average 3 lb. 4 oz.) during previous year.

Research (1) *Swarm prevention.*—Swarming in bees is a potent instinct for the perpetuation of their species. This phenomenon is disadvantageous in the sense that it depletes the population of the colonies rendering honey-storing impossible. Two sets of experiments were conducted to mitigate this impulse. The first one, in short, consists of an artificial division of the strong colonies just when they develop the impulse. The original queen is separated with a small population of the workers and her daughter allowed to emerge and function in the natural course. There can be no egg-laying during the interval between the removal of the old queen and the advent of the new one since most of

the existing sealed and unsealed brood would have emerged as adults. As the presence of the young brood and the superfluity of the young bees form potent factors for developing the swarming impulse, the artificial manipulation retards the phenomenon. The other process consists of artificially equalising the worker force of a strong and a weak colony and the method was tried for the first time. Between the two, the former offers more promise, but the observations could not be pursued to conclusive ends since the weather and seasonal factors were not quite favourable. These investigations will be continued.

(2) *Pollen substitutes.*—The adverse season for bees commences from about June and extends till November when pasturage and weather conditions are not satisfactory. The bee population in most cases, dwindles down to such a low level that it could not be built up again for the ensuing honey season. The reduction is chiefly due to the dearth of the bee-foods, honey and pollen. The former could easily be made up by artificial feeding with sugar. Experiments have been in progress for the past several years to augment the pollen supply with different kinds of flours and meals, but all these attempts were failures though the foreign bees are reported to subsist on various pollen substitutes during the winter. The Indian bee was found to relish a mixture of soya bean flour, yeast and jaggery for the first time, the maximum daily intake being about 10 grs. This quantity is obviously not enough to improve the condition of the colonies and attempts are being made to increase the same. The influence of the feeding on brood-rearing, population, weight and general progress of the colonies is being carefully recorded and it is hoped that conclusive results, if any, on these investigations would solve the problem of maintaining the colonies during the slack season.

Control of bee enemies.—In addition to the definite methods of control already evolved against the wax moth, immersing the empty infested combs in warm water at 40°C was also found to kill the caterpillars Observations were continued on the habits of the little known bee-enemy *Acanthaspis siva D.*

Minor items of research on bee-keeping consist of observations on the general fluctuations in the weights of bee-colonies during the different seasons, selection and isolation of colonies with desirable traits, fecundity and longevity of queens, bee-pasturage, etc. etc. The queens were found to live for over two years but their fecundity was at its highest during the first two years only.

Propaganda.—The public interest in this industry appears to have revived itself during the year as evidenced by the numerous enquiries for advice and help. A perceptible increase is also noted in the number of colonies maintained in this State by enthusiasts. Compared with the 6,850 hives reported to be in a flourishing condition during 1946, a recent census has shown an increase to

8,492 hives. This section also arranged for the supply of the standard appliances necessary for the industry, the more noteworthy feature being the high popularity of our comb foundation sheets. A machine for making these sheets was obtained during 1939 and this appears to be, probably, one of the few in working condition for the whole of the Indian Union, since heavy demands are being received from the other States as well. A total quantity of 155 lb. was manufactured and distributed during the current year.

J. SYSTEMATIC WORK.

Attention was devoted to the proper upkeep of the valuable insect collection in the Section. Sorting out the miscellaneous collection into the various orders, families, etc., was also attended to by various members of the staff. The preparation of review of literature on Thysanoptera was continued under the auspices of an I.C.A.R. Scheme. The review of systematics, classification, phylogeny, morphology and biology of the group was in progress and considerable ground was covered. Detailed studies on the larval characters and wing venation of Lepidoptera were also pursued. Systematic study on other groups like Coccidae, Cecidomyidae, Acarina, etc., was continued.

III.-A. TEACHING.

The following classes were conducted for the B. Sc. (Ag). degree course :—

	Lectures.	*Practicals.*
First year	68	45
Second year	40	54

The terminal and University examinations were conducted as usual. Messrs. K. P. Ananthanarayanan and A. R. Seshadri served as internal examiners for the Second and First year University examinations, respectively. A few lectures and practical classes on Horticultural Entomology were conducted for the benefit of the Horticultural trainees.

III-B. TRAINING.

One warder from the Central Jail, Salem, Sri Krishnaswamy Chetty, a candidate deputed by the Employment Exchange, Coimbatore, about a dozen Air Force personnel and Sri Chenthamarakshan, Superintendent, Crofton Estate, underwent training in bee-keeping for varying periods.

IV. REVIEW OF WORK UNDER SPECIAL SCHEMES.

A. GROW MORE FOOD SCHEMES.

I. *Plant Protection Scheme.*

The Plant Protection Organization (Entomology) continued to function under two officers, one stationed at Coimbatore and the other at Bapatla.

Season.—The season in the Southern region was on the whole highly unfavourable. The south-west monsoon was late and even deficient in some of the districts. The nort-heast monsoon proved to be a phenomenal failure and acute drought conditions were experienced in the districts like Ramanathapuram, Tirunelveli, Madurai, Salem, North and South Arcots and Coimbatore as well. In the Northern zone, the south-west monsoon broke out in proper time but tailed off prematurely, the districts comprising the Rayalaseema suffering most. The succeeding monsoon was a general failure all over the area except for the unusually heavy precipitation which caused more harm than good to some of the districts. In short, the seasonal factor were highly unfavourable all over the State during the year under report. The redeeming feature, however, is the receipt of some pre-monsoon showers in the northern region during the summer of 1951, which on the whole, had a salutory effect on the prevailing drought conditions.

Equipment.—A compliment of 520 dusting machines of various patterns was added to the existing stock to meet the heavy demand for the plant protection service. Besides these, four rotary dusters and 50 locally made hand bellows dusters were sold to private parties in the northern zone. Over 750 tons of the different insecticides were procured and a major portion of these expended, retaining adequate stocks in reserve to meet emergencies.

Plant Protection work.—The adaptability and ready availability of the two new synthetic chemicals—DDT and BHC were fully exploited and a variety of crop pests were successfully dealt with on a field scale. A gist of the work done is furnished in *Appendix I.*

Bee-keeping.—Renewed interest in this agro-industry was evinced by the public. Intensive work was concentrated with the help of 29 special maistries in the favourable localities of the Northern Circars. These men helped the enthusiasts in maintaining about 3,500 colonies in the northern zone and it is reported that this pleasant hobby is gaining a rapid popularity as a paying proposition in the Circars. Equal attention was bestowed on the subject in the southern districts as well.

Control of the coconut caterpillar Nephantis serinopa M.—Two parasite breeding centres were functioning at Razole and Narasapur but the latter was closed by 9th April 1951. Over one lakh of the Bethylid (Paresierola nephantidis) 34,000 of Elasmus nephantidis, another lakh of Braeon brevicornis and over 2½ lakhs of the Eulophid (*Trichospilus pupivora*) are reported to have been colonised in the zone and it is presumed that this intensive work has been responsible in keeping the pest at bay over 80,000 acres of this valuable palm. In the southern zone, the work was concentrated in Salem district and over 22,000 Eulophids, 2,700 of Bethylid were liberated in infected areas.

2. *Civil Supplies Sto age Scheme.*

Four Regional Assistant Entomologists were stationed at Coimbatore, Tiruchirappalli, Madras and Vijayavada for the perio-dical inspection of the stocks of foodgrains maintained by the Civil Supplies Department. They rendered valuable service by advising the District Collectors and the Board of Revenue regarding the condition of the food stocks, suggesting suitable priorities in disposal, disinfesting the godowns and the stocks themselves whenever necessary. They were under the technical guidance of the Government Entomologist. Enormous quantities of foodgrains were handled and saved from any deterioration by the insect pests and rodents and an idea of the quality and quantity of work turned out can be had from the following statement :—

Name of zone.	Stocks examined at ports in tons.	Stocks inspected in godowns in bags.	Stocks re-conditioned in bags.	Stocks fumigated in bags.	Stocks disinfected in bags.	Godown space disinfested in square feet.	Stock in respect of which special priorities were recommended.
Coimbatore ..	250,658	3,529,200	8,190	346	983,275	128,200	70,238
Tiruchirappalli ..	..	1,499,636	10,166	7,899	370,262	..	193,778
Madras ..	258,077	1,865,655	3,424	14,643	469,724	71,200	21,689
Vijayavada ..	..	1,127,979	..	2,078	613,337	404,250	..
..	608,735	8,022, 70	21,780	24,966	2,436,598	603,650	285,705

Besides the routine work, attention was also devoted to the improvement of the disinfestation technique. Gas proof fumigation covers were brought into frequent use and the process was thus made considerably easier. Another improvement was the adoption of Calcium cyanide for fumigating infested rice stocks. The procedure was still recently considered detrimental to the edible qualities of this commodity but recent investigations have shown that the absorption of HCN is just the same as in the case of other foodgrains and as such the fumigation of this material is being conducted as a routine measure.

B. Other Schemes.

(i) *Sugarcane Borer Pests Scheme (Indian Central Sugarcane Committee Scheme).*

An intensive programme of research was followed on the study of the borer pests of sugarcane with reference to their incidence, nature and extent of damage, influence of the weather factors such as maximum and minimum temperatures, wind velocity and direction, relative humidity and rainfall, on their population, alternative host plants, natural enemies, varietal resistance, etc. The observations were conducted on varieties Co. 413, Co. 419, Co. 421 at the Central Farm, Coimbatore and a gist of the results is given below.

General habits and the biology of the borers.—The observations were pursued on the same lines as in previous years. The borers concerned are (i) the early shoot borer *Argyria* (*Proceras*) *sticticraspis Hmp*, (ii) the cane borer, *Diatraea* (*Proceras*) *venosata Wlk* and (iii) the top shoot borer—*Scirpophaga sp.* Of these, *Argyria* infests the crop from its very germination and continues its activities till about July after which it slowly tails off. The caterpillars bore into the young tillers and kill them outright. The percentage of infestation ranged from 0·2 to 16·8, 0·3 to 16·5 and 0·2 to 18·4 for the three varieties Co. 413, Co. 419 and Co. 421 respectively. The indications of the influence of meteorological factors are that high temperatures, low humidities and a few sharp showers during the summer months are conducive for its multiplication. *Diatraea* is first seen by July and its virulence goes on steadily increasing till harvest. As the pest appears only after the canes are formed, it does not affect the life of the plant though it causes a deterioration in the quality and quantity of the juice of the infested canes. The percentage of infestation in this case ranged from 0·2 to 16·6, 0·2 to 28·6 and 0·4 to 32·3 for the three varieties Co. 413, Co. 419 and Co. 421 respectively. As opposed to *Argyria*, low temperatures, high humidities and light rainfalls appear to be conducive for the prolific multiplication of this pest. Another aspect of the investigations was the mortality and compensation studies. The emergence of the mother plants as well as the tillers, their mortality, if any, due to the borers and other causes, the subsequent compensation along with the actual loss in yield caused by borers, etc. A gist of the findings is that Co. 413, 419 and 421 produced 8·9, 6·1, 5·5 tillers per mother plant respectively and out of these 6·4, 3·9 and 3·5 died due to various causes, leaving a balance of 2·5, 2·2 and 2·0 which developed into mature canes. The voluminous data concerning these are being sent to the Sugarcane Specialist, Bihar, for statistical analysis and evaluation of results.

From the experience gained so far, Co. 419 gives indications of being more susceptible to the borers but the susceptibility may after all be more apparent than real since this variety has a low tillering capacity, Microclimatic observations were also recorded for the three varieties but no appreciable variations were noticeable. A number of wild grasses collected from the near vicinity of the sugarcane areas were examined to see whether they harbour any of the borers. Only *Saccharum spontaneum* was found to harbour *Diatraea venosata* and *Scirpophaga*. The gross percentage of infestation was 6·2. of which *Scirpophaga* contributed 5·6 and *Diatraea venosata* 0·5. The results of the observations are not very helpful in the control of the borers since they are found both on the sugarcane as well as on the wild plants at about the same period. No new parasites were observed.

(ii) *Rodolia Breeding Scheme* (*Post-war Development Scheme*). One of the important aspects of this line of work is the regular periodical survey of the entire Nilgiris and Kodaikanal tracts along with the surrounding areas of Periyakulam, Pattivirampatti etc., with reference to the incidence and distribution of the notorious scale, *Icerya purchasi Mask.* The scale was present in a mild form on gorse with stray specimens occurring on *Acacias* and citrus in both the localities. A few isolated specimens were also found on casuarinas in the Periyakulam area. A rigorous watch was kept over the nurseries and new plantations of the economic wattle,—*Acacia decurrens.* The Entomological Laboratories at Fernhill and Kodaikanal were working satisfactorily and in all 48,800 beetles were bred and released, 35,500 on the Nilgiris and 13,300 at Kodaikanal. A nucleus stock was also maintained for further multiplication and meeting the demand from other States as well.

Observations on the influence of weather factors on the pest and the predator show that the chill rainy periods retard their multiplication, while a continued bright sunny weather is favourable to both. Among the indigenous natural enemies, *Rodalia roseipennis M.Scymnus sp.* the *Cecidomyid* as well as *Stathmopoda melanochra M* were found in fluctuating numbers, but even the combined effects of these could not equal that of the imported beetle *Rodolia cardinalis* in keeping down the pest.

A careful eye was also kept for alternative host plants and in addition to the already existing formidabale array of over 120 plants, three more—*Parthenium camomilla*, *Carissa paucinervia A. Dc.* and *Fagopyrum esculentum Moench.* were recorded. The assidu-ous breeding and colonization of the predator beetle has had a profound effect in keeping down the scale within controllable limits. The potentialities of this scale as a destructive pest of fruit trees, especially oranges and of the commercial wattle *Acacia decurrens* being fully realized, a vigilant watch was maintained on the progress of the scale and it has to be continued at the same level until it is completely wiped out from the two infested areas.

Plant quarantine work.—Concurrent with the intensive biological control work, active steps were taken to prevent the pest from spreading to other areas. Two quarantine stations, one at Shembaganur and another at Mettupalayam were functioning satisfactorily throughout the year. Consignments of notified plants, susceptible to *Icerya purchasi* were intercepted during transit, scrutinized and fumigated with Calcium cyanide and then only allowed to pass. Over 1,210 tons of wattle bark and a large number of fruit plants were fumigated and passed. Besides these, hundreds of ornamental plants, cuttings, flowers, etc., were either examined or fumigated and passed. A number of consignments were also confiscated.

(iii) *The Orange borer scheme—(Indian Council of Agricultural Research).*

The Cerambycid borer—*Chelidonium cinctum G*—wasund er investigation at Wynaad under a special scheme sponsored by the Indian Council of Agricultural Research and almost the last word can be claimed to have been pronounced on the control of this troublesome beetle.

An intensive survey of the incidence and distribution of this pest was made during 1949–50 and since about 40 per cent of the total area of 5,000 acres was covered during that period, attention was switched on to the more important lines of research on the biology, life-history and control of the borer. The identity of beetle concerned was definitely established to be *Chelidonium cinctum Guer*, the previous surmise as *Chloridolum alcmene Th.* being a mistake. The former is the major pest at Mysore also. A striking difference between the Mysore and Wynaad specimens is that the former, in most cases, is characterized by the presence of a pair of transverse yellowish bands at the middle of the bluish green elytra, whereas all the 500 adults collected and examined from Wynaad had a uniformly bluish green colour without even a single one with the yellowish bands.

Life-history and habits.—These aspects were studied in some detail under field conditions. The adults emerge soon after the heavy showers in June-July and lay their eggs singly in the axils of branches at the terminal ends. The grubs hatch out in about twelve days and begin to bore into the stem. They first effect a spiral cut disconnecting the bark from the woody portion which results in the characteristic wilting of the infested twigs. The grubs have the peculiar habit of tunnelling upwards for a period of two to six weeks, and later reverse the direction of their progress towards the main branches below. They eventually reach the main stem while the damage caused gets steadily intensified as the grubs bore a net work of the tunnels and feed voraciously on the core of the tree. The activity of the borers is evinced by the ejection of appreciable quantities of chewed fibrous material through the holes which are previously cut out for aeration and for the future emergence of the adults. The larval period lasts for about ten months and the pupal one for three to four weeks. The pupation takes place inside tunnel itself. The beetles emerge by about May, remain inside for a few days, probably for their wings to get hardened and come out of the tree only after the receipt of some heavy rains. There is only one generation for a year. The number of grubs inside a tree may vary widely but the maximum recorded so far, is as high as twenty six. The damage which so many of these borers are capable of causing to a tree during a season can be better imagined and any further stress is hardly necessary on the havoc the borers are capable of by their regular infestation on the same tree year after

year with the same degree of virulence. The pest has not been found to breed on any alternative host plants. No natural enemies were noted to exert any check on any of its stages.

Control.—Insecticidal as well as mechanical methods were tried on a field scale and some very interesting results achieved.

(*a*) *Insecticidal.*—These were conducted at two centres, Kalpetta and Menangadi, with the object of studying the lethal as well as deterrent effects of BHC and DDT sprays at 0·1 and 0·05 per cent. The treatments were commenced by May prior to the probable emergence of the beetles and repeated every week until July when the emergence generally ceases. In all, ten rounds of the sprays were given and the results assessed mainly by noting the subsequent incidence of wilted twigs which is the definite symptom of infestation. Counts were taken on six trees selected at random under each variant. At Kalpetta, it was found that the occurrence of the wilted twigs per tree was the least on those treated with BHC 0·1 per cent. The number being 1–2, as compared to 2–4, 1–4, 1–4 and 3–7 in the case of BHC 0·5 per cent, DDT 0·1 and 0·05 per cent and control respectively. The indications are that the damage has been the least in the case of BHC 0·1 per cent. At Meenangadi, only 0·1 per cent concentrations of the two chemicals were tried. The infestation was more severe in this estate. The details regarding the range of infested twigs are 2 to 5 for BHC, 1 to 6 for DDT as against 4 to 17 in the controls. The data indicate the deterrant action of the chemicals to varying degrees, though there was no evidence of any lethal effects on the adults. The cost of the ten rounds of BHC spray 0·1 per cent which appears to show some promise, was computed to be Rs. 150 per acre inclusive of the labour charges.

(*b*) *Mechanical.*—The clipping of the wilted twigs within the critical period of two to six weeks when the young grubs are still in the terminal portions has been found to be highly efficaceous in Mysore and the same was adapted with a remarkable degree of success at Wynaad also. This is one of the few cases where the vulnerable point in the life-history of the insect has been taken advantage of for its control. The grubs, in their earlier stages, are invariably located inside the twigs which snap at the slightest touch, owing to the point of entry being rendered weak by the spiral cut. Once the twig breaks and falls to the ground, the grubs are unable to get back to the tree and the latter is saved to that extent from that grub. The operation itself can be done with a long bamboo having a forked end. The wilting being characteristic, such twigs can be spotted out even by an illiterate labourer. A coolie at Rs. 2 was able to cover about 2 acres in a day and as four rounds may be necessary, the overall cost of the operation may work out to Rs. 4 per acre.

The chemical method of control is practically out of question on account of its prohibitive cost and the practical difficulties ordinarily encountered in conducting the spraying operations in these hilly tracts during monsoonish weather. The mechanical method of clipping the wilted twigs on the other hand, is more feasible on account of its cheapness, extreme simplicity of operation and thoroughness.

The orange borer, being a serious problem to the locality, most of the enlightened planters were keenly following the progress of the experiments. The clipping method appears to have readily appealed to them. With little or no persuasion, about 40,000 trees are reported to have been treated, the number of wilted twigs removed exceeding 235,000. The results of this large scale operations are two fold. Apart from saving such a large number of trees, the fact that over two lakhs of the borers have been prevented from coming into existence hardly requires any emphasis here.

Control of the grown-up borers.—Injection of chemicals like Carbon-di-sulphide, Killoptera, chloroform, petrol and kerosene into the bore-holes ejecting fibrous matter was tried on an experimental basis. The results were observed after 24 and 48 hours and one week, the absence of the ejection of chewed refuse being taken as an indication of success. It was found that three rounds of treatment were necessary to get complete relief and petrol gave a 90 per cent kill at the lowest cost of Re. 0-1-4 per tree inclusive of labour, kerosene, coming next in cheapness. These fluids can be easily injected with a hypodermic syringe.

The shoot borer (*Obera mangalorensis*).

This is a borer of minor importance attacking only the seedlings and side shoots. As its control can be easily effected by clipping the infested shoots, no further work was done.

The purple scale (*Lepidosaphes beckii N*). This scale occurred on a mild form during May and the opportunity was utilized for some insecticidal trials. Aqueous sprays of BHC and DDT at 0·2 and 0·1 per cent, Chlordane (1 lb. in 6½ gallons of water), BETP 0·2 per cent, Parathion 0·025 per cent, DDT-MKE emulsion 0·16 and 0·32 per cent and crude oil emulsion 1 in 8 were the variants experimented with. The results were inconclusive, owing to the low scale population but the general indications are that Parathion and DDT-MKE emulsion offer greater promise of control. The work will be continued.

V. MISCELLANEOUS.

(*a*) *Fumigation.*—About 35 small and large scale fumigations were conducted either with Calcium cyanide or Killoptera and phytosanitary certificates issued whenever necessary. The important items in this category are the large scale treatments of the

seed material received from the breeding stations and about two lorry loads of deal wood planks belonging to a private firm which were severely infested with Bostrychids.

(*b*) *Visitors.*—The Hon'ble Minister for Agriculture, Madras and Bombay, visited the exhibition put up in connection with the College Day and Conference, 1950. Other distinguished visitors during the year were Sri S. V. Ramamoorthy, Honorary Regional Food Commissioner, Members of the Agricultural Policy Committee of the Madhya Pradesh Government, Sir John Russel, Dr. C. H. Edelman of Holland, Members of the Chinese delegation headed by Prof. Woon Young Chun, Dr. A. J. Millington of Australia, Dr. Muntzing, Cytogeneticist of Sweden, and Sri N. J. Kamath, Under Secretary to the Government of Madras. The Collector of Coimbatore, the Deputy Registrar of Co-operative Societies and Sri V. C. Palaniswamy Gounder, M.L.A., Honorary visitors, paid their usual visits and gave valuable suggestions and opinions regarding the work of the section. A number of batches of students from various Educational institutions also visited the section and apiary.

(*c*) *Publications.*—The following papers were prepared and submitted for publication during the year :—

(i) *Cyphocera varia F.*—a Tachinid parasite on Spodoptera —By Sri S. Ramachandran [*Indian Journal of Entomology*, Volume XII (1), 1950].

(ii) Preliminary studies on brood rearing and hive population of *Apis indica F*—By Sri S. Ramachandran and Sri V. Mahadevan [*Indian Bee Journal*, Volume XII (11 and 12).]

(iii) Biological control of the early shoot-borer of Sugarcane by Trichogramma—By Sri S. Ramachandran, Sri C. Krishnamoorthy and Janab Muhammad Basheer (paper read at the First Biennial Conference of Sugarcane Research Workers).

(iv) The wax moths and their control—By Sri S. Ramachandran and Sri V. Mahadevan (sent for publication in *Indian Bee Journal*).

(v) An account of plant protection work done in Madras—By Sri S. Ramachandran (for publication in the Plant Protection Journal, published by Government of India).

(vi) Bees and Bee-keeping—By Sri S. Ramachandran (for publication in the Tamil Encyclopaedia).

(vii) A short review of work done on bee-keeping in Madras —By Sri S. Ramachandran (Extracts published in *Indian Bee Journal*, Volume XIII, Parts 5 and 6).

(viii) Manuring of crops in relation to Insect Pests—By Sri S. Ramachandran (paper read at the College Day and Conference, 1951).

(ix) A popular account of the trials with DDT and BHC in the Madras State—By Sri S. Ramachandran (for publication by the Indian Council of Agricultural Research).

(x) Investigations on *Nephantis serinopa* and its control by the biological method—By Sri Y. Ramachandra Rao, Sri M. C. Cherian and Sri K. P. Ananthanarayanan (*Indian Journal of Entomology*—Volume 2, 1948—Issued in November 1950).

(xi) The Bher fruit fly and its control—By Janab Muhammad Ghouse Basha (for publication in the *Indian Journal of Entomology*).

(xii) Peculiarities and adverse effects of DDT and BHC—By Kumari I. P. Janaki, Sri K. R. Nagaraja Rao and Sri T. R. Subramaniam (paper read at the First Conference of Scientific Research Workers).

(xiii) Assessment of loss in yield in Sorghum due to *Calocoris angustatul*—By Sri N. Raghava Rao and Sri K. R. Nagarajan (paper read at the First Conference of Scientific Research Workers).

A number of popular articles were also submitted for publication in the newsletter series and the departmental journals. As desired by the Secretary to the Commissioner of Civil Supplies, a pictorial pamphlet on Insect Pests was prepared and sent for publication.

COIMBATORE,
8*th August* 1951.

S. RAMACHANDRAN,
Government Entomologist.

Appendix I.

Statement showing the plant protection work done in the Madras State during 1950–51.

Name of pest.	*Savings.*		
	Area treated in acres.	*Yield in tons.*	*Money value.*
(1)	(2)	(3)	(4)
			RS.
I. Rice.			
The Swarming caterpillar of Rice (*Spodoptera mauritia B*).	2,339	977	..
The Rice grasshopper (*Hieroglyphus banian F*).	1,936	562	..
The Rice caseworm (*Nymphula depunctalis Gr*).	2,780	236	..
The Rice leaf tolder (*Cnaphalocrocis medinalis Gr*).	1,344	187	..
The Rice leaf hoppers (*Nephotettix sp and Nilaparvata sp*).	6,977	657	..
The Rice leptispa (*Leptispa pygmoea B*).	8,240	755	..
The Rice stem borer (*Schoenobius incertellus W*).	1,614	129	..
The Rice hispa (*Hispa armigera* 01) ..	430	40	..
The Rice root grub (*Echinocnemus oryzae M*).	1,237	197	..
The Rice bug (*Leptocorisa acuta Th*) ..	685	61	..
The Rice skipper (*Parnara mathias F*) ..	308	28	..
The Rice mealy bug (*Ripersia oryzae Gr*).	134	12	..
The Rice thrips (*Thrips oryzae W*) ..	65	6	..
The striped bug of rice (*Tetroda histeroides F*).	68	6	..
The Rice flea beetle (*Chaetocnema sp*) ..	60	10	..
Other minor pests of rice	86	7	..
Field rats (*Millardia meltada, Gunomys kok, etc.*)	19,277	2,338	..
II. Wheat.			
Surface grasshoppers (*Chrotogonus sp*) ..	5	5	..
III. Sugarcane.			
The early shoot-borer (*Argyria sticticraspis H*).	112	112	..
Other miscellaneous pests (*Termites, Aleurodids, etc.*).	19	12	1,220
IV. Millets.			
1. Sorghum—			
The Sorghum earhead bug (*Calocoris angustatus L*).	5,978	400	..
Surface grasshoppers (*Chrotogonus sp and Aeolopus sp*).	91	7	..
The Deccan grasshopper (*Colemania sphenarioides B*).	402	42	..
The shoot caterpillar (*Cirophis sp*). ..	51	3	..
The Sorghum mite (*Paratetranychus indicus H*).	631	43	..

Name of pest.	Savings. Area treatd in acres.	Yield in tons.	Money value.
(1)	(2)	(3)	(4)
			Rs.
IV. MILLETS—*cont.*			
2. Ragi and panivaragu—			
The ragi leaf noctuid (*Laphygma exigua Hb*).	215	.41	..
The ragi thrips (*Heliothrips indicus B*).	16	1	..
Flea beetles (*Chaetocnema, etc.*)	197	37	..
Other minor pests (root and leaf aphids, jassids, etc.)	170	14	..
3. Cumbu and tenai—			
The earhead bug (*Calocoris angustatus L*).	13	1	..
Other minor pests (grasshoppers, flea beetles, etc.)	587	85	..
V. VEGETABLES.			
Miscellaneous pests like Epilachna sp. aphids, mealy bugs, etc., on various vegetables.	4,207	648	3,49,922
The onion thrips (*Thrips tabaci L*) ..	629	96	1,09,673
Pests on cruciferous vegetables (cabbage bug, cutworms, etc.)	323	162	..
The pumpkin beetle (*Aulacophora sp.*)	32	2	..
VI. FRUITS.			
Miscellaneous pests like mango hoppers, the citrus caterpillar, red tree-ant, mites, etc.	85,747 trees.	..	1,19,738
The grape vine flea beetle (*Sceledonta stirigicollis M*).	88	35	..
Mites on grape vine	4	2	..
The plantain cutworm (*Prodenia litura F*).	20	1	..
VII. PULSES.			
Miscellaneous pests like plant lice, caterpillars, etc.	151	1	2,000
VIII. OILSEEDS.			
The red hairy caterpillar (*Amsacta albistriga M*).	830	149	..
The groundnut aphid	318	13	15,262
The groundnut surul (*Stomopteryx nerteria M*).	525	58	11,602
The gingelly leaf and pod caterpillar (*Antigastra sp.*).	430	..	3,400
The coconut caterpillar ((*Nephantis serinopa M*).	80,940 trees.	..	20,00,000
The palm beetle (*Oryctes rhinoceros L*) ..	2,201 trees.	..	820
Other miscellaneous pests on coconuts (termites, psychids, etc.)	10,280 trees.	..	..
X. FIBRE CROPS.			
Miscellaneous pests on cotton (jassids, boll-worms, etc.).	626	26	600
The jute semilooper	46	..	..

Name of pest.	Savings		
	Area treated in acres.	Yield in tons.	Money value.
(1)	(2)	(3)	(4)
X. Spices.			Rs.
The chillies thrips (*Scirtothrips dorsalis H*).	40,997	2,964	34,72,698
Other miscellaneous pests on chillies (Mealy bugs, mites, etc.).	53	13	..
XI. Narcotics and Drugs.			
The tobacco aphid (*Myzus persicae S*).	111	..	9,090
Other miscellaneous pests on tobacco (caterpillars and beetles).	283	..	46,000
The betel vine bug (*Disphinctus politus W*).	276	..	1,24,540
XII. Flower Plants.			
Thrips on jasmine (*Isoneurothrips orientalis B*).	13	..	2,520
XIII. Stored products pests.			
Miscellaneous pests in the seed material stored in various agricultural depots.	19,683 bags.	..	†
XIV. Rodents.			
Rats on vegetables.	125	..	6,250
Rats on pulses.	246	..	2,200
Rats damaging chillies.	351	78	1,500
Rats damaging coconuts.	5,600 trees.	..	..
Rats damaging tapioca.	1,576	13	..
Rats damaging potatoes.	948	85	..
Rats on sugarcane.	30	30	..

Note.—* Figures for south zone not furnished.

† Figures not furnished in respect of both the zones.

Appendix II.

Salient features of the achievements during the period 1st July 1950 to 30th June 1951.

Entomology Section.

Appreciable progress was made during the previous year on the control of crop-pests which feed externally and the current year's work comprises of concentrated research on the internal feeders and sucking insects like coccids, aphids, etc., the solution of which has been a problem for some years. Considerable work was also done on the adverse effects attendant on the use of BHC and DDT. A resume of the work done on these lines is furnished below, cropwar :—

1. *Rice.*—Among the pests of this important food crop, indicative results were obtained in the case of the stem borer. The critical period of the emergence of the adults were first determined and different concentrations of DDT and BHC sprays were applied to the crop at the

nursery and shot-blade stages to assess their deterrent effects on the adults and the lethal action, if any, on the caterpillars hatching out of the egg masses. The results revealed that the Thaladi crop at Aduthurai, which generally suffers most from this borer, had a comparatively lower incidence of 5·61 per cent in the case of BHC 0·1 per cent as against 14·12 per cent in the controls. Conclusive evidence regarding the equal efficacy of DDT both as dust and spray against the rice jassid was gathered. Investigations show that the mole rat and the grass rat are the commonest species occurring in Tanjore. of which the former is highly destructive. A study of the comparative merits of baiting with zinc phosphide versus digging out and catching and bow trapping, show that the mole rat is somewhat shy of the baits and that the mechanical methods though laborious, are more perfect.

2. *Millets.*—The higher efficacy of the stronger concentrations of BHC dust was established against the cholam earhead bug. Considerable time was also spent in assessing the reduction in the yield caused by this capsid. The pest was more widespread than severe during the current year and the computed loss of grain ranged from 15 to 30 per cent. Of the various experiments made against the cholam fly, periodical sprays with BHC effected a reduction in the infestation to an appreciable degree. Preliminary attempts on the biological control of the cholam stem-borer with the egg parasite—Trichogramma—afforded scope for further investigations, since the damage was decreased by 4 per cent.

3. *Oil seeds.*—Regarding the pests of these crops, the coconut-leaf caterpiller was successfully kept in check all over the State by a large scale multiplication and liberation of its specific parasites. The caterpillars on young trees were also found amenable to control by BHC spray. Higher concentrations of BHC dust have caused an appreciable kill on the notorious red hairy caterpillar of dry crops. The incidence of the capsule and shoot-borer of castor against which very little could be done so far, was warded off by periodical applications of BHC and DDT. Other pests on which interesting results were obtained comprise of the castor semi-looper, the costor slug and the leaf noctuids.

4. *Fibre crops.*—Periodical liberations of Trichogramma reduced the damage by the cotton boll-worms, the reduction in the infestation being about 13 per cent, not to speak of the definite improvement in the quality of the kapas. The cotton jassid as well as the thrips were controlled by DDT and BHC respectively.

5. *Vegetables.*—Interesting results were obtained on the control of the potato-tuber moth in the field by the application of BHC sprays. Confirmatory test with DDT established its efficacy against the bhendai jassid. A serious outbreak of cutworms on young snakegourd plants at Coimbatore was an experience by itself and the worms were annihilated by the application of BHC and DDT dusts round the pits.

6. *Fruits.*—Substantial progress was made on the control of three of the major pests of fruits. The problem of the Cerambycid borer of oranges which was serious at Wynaad, was definitely solved by adapting the simple expedient of removing the wilted twigs within the critical period. The method was so convincing that a good number of the planters took it up spontaneously and over 40,000 trees were saved in the first instance at a very low cost. The control of grown up borers by injecting small quantities of petrol is another achievement of the section during the year. The liquid can be pumped in with a hypodermic

syringe, the cost of the treatment being Re. 0–1–4 per tree. Another serious pest of oranges is the fruit sucking moth against which there were till now no feasible methods of control. Three sprays of DDT given at tri-weekly intervals have indicated a reduction in the fruit fall. Another pest which has been lying over for some years is the ber-fruit fly. The synthetic chemicals were given a fair trial and periodical applications of DDT sprays reduced the infestation and appreciated the yield to a money value of Rs. 10 per tree. Of the other pests of fruits which were controlled by various means come the sapota leaf-webber, the San jose scale, the red tree-ant, the apple wooly aphis etc. One of the potential enemies of fruit trees on the hills is the fluted scale—an exotic insect. An assiduous colonization of the predator beetle has practically wiped out the pest from most of the wild vegetation on which it was thriving in enormous numbers.

7. *Coccids and aphids.*—Preliminary work on a variety of these bugs has indicated the possibility of their control by some of the new synthetic formulations like DDT, BHC, Parathion, etc.

8. *DDT and BHC as seed preservatives*—Seed material was mixed with BHC and DDT dust and kept under observation. These were found to be free from insect damage up to a period of one year without their viability being affected in any way.

9. *Adverse effects of DDT and BHC.*—Another important line of investigation which has yielded interesting results is the adverse effects attendant on the use of BHC and DDT. Though these chemicals are a blessing to the farmer, yet their indiscriminate use is also fraught with some undesirable consequences. One of the common instances is these heavy incidence of pests like aphids and mites on crops treated with DDT. This phenomenon is brought about by the specific lethal action of the insecticide on the parasites and predators, that keep these pests in check and the feeble effect it has on the pests themselves. The use of these chemicals is also attended with certain phytotoxic risks. Cucurbits and a few other plants are sensitive to these. BHC causes a quicker wilting of the plants while the evil effects of DDT are slower and not so spectacular. The chemicals were also found to impart their peculiar flavour to some of the edible fruits and vegetables.

10. *Fumigation with calcium cyanide.*—While dealing with the problem of seed storage, the inadvisibility of fumigating oilseeds with Calcium cyanide came to light. Seeds like castor, gingelly, groundnut and cotton were found to absorb and retain HCN beyond the safety limit' though their viability was not affected.

Beside these, the maintenance of the general and economic collection and specialization in some of the groups formed another important activity of the section.

Imparting accurate and up-to-date knowlede on Economic Entomology to students of B.Sc. (Ag.) course, horticultural trainees, bee enthusiasts, etc., forms a routine but important item of the section's work.

Dissemination of research.—The results achieved by the section were transmitted to the ryots by the Plant Protection staff. The storage organization under Civil Supplies department rendered valuable service by way of giving proper advice on the conservation of the food-grains as well as in the execution of large scale fumigations which has

gone a long way towards relieving the present acute food scarcity. Valuable service was also rendered towards popularizing bee keeping, the distribution of the comb foundation sheets being a note-worthy feature.

Items wherein no positive achievements are available so far.—Investigations on the rice stem borer, the rice mealy bug, the rice gallfly have to be pursued to conclusive ends. The technique of poison baiting against rats should be improved. Long-range problems like the correlation between the weather factors and the incidence of borers on sugarcane may have to be continued. Knowledge of the possibilities of biological control of the cholam stem borer, the Cotton boll-worms, as well as the castor semi-looper is still in the initial stage and has to be developed further. Control of the potato tuber moth in the field as well as in the godown requires perfection. Control of coccids and borer pests of some of the fruits like the pomegranate fruit borer, the orange scale (*Lepidosaphes beckii N*) has not yet passed the experimental stage. An exhaustive study on the adverse effects attendant on the use of BHC and DDT would constitute a major problem of research for some years to come. Along with these, the influence of the contact of seed material with DDT and BHC, a Clcium cyanide, etc., on their viability, immunity from insects and the possible untoward effects on the edible qualities will also be studied. Under bee-keeping, swarm prevention and finding out an artificial pollen substitute would constitute the major lines of research along with the general observations on the breeding habits of bees, bee pasturage, bee enemies, etc.

Appendix III.

Programme of work for 1951–52.

Entomology Section.

I. Pests of rice—	
1 The rice stem borer (*Schoenobius incertellus W*).	Results of the experiments conducted during the previous year at the Agricultural Research Station, Aduthurai, indicate a certain amount of reduction in pest incidence when DDT and BHC are sprayed (0·05 and 0·1 per cent) soon after the critical period of emergence of the moths during the seed-bed and shot-blade stages and the figures are more in favour of BHC. The findings will be verified in bulk plots at Aduthurai as well as at the other Rice Research Stations. Besides these two chemicals, a few other synthetic preparations like Chlordane, Parathion and HETP will also be tried at the Agricultural Research Station, Aduthurai, Varietal resistance will also be studied up to the limits possible.
2 The rice mealy bug (*Ripersia oryzae Gr.*),	The influence of the above mentioned sprays on the control of the initial infestation in the seed beds will be studied at the Agricultural Research Station, Aduthurai. Other Rice Research Stations will restrict their trials to BHC and DDT. Patches occurring in the fields will also be treated with the above chemicals and the results regarding the bug mortality as well as the spread of the characteristic patches will be recorded.

I. Pests of rice—*cont.*

3 The rice cecidomyid (*Pachydiplosis oryzae W*).	Previous trials at Ungathur (West Godavari district) with light traps, though indicative, do not promise to be practicable. The new synthetic chemicals DDT and BHC were given a fair trial but no conclusive results could be drawn owing to the low incidence of the pest during 1950. It is proposed to repeat the trials in co-operation with the Crop and Plant Protection Officer (Ent.), Bapatla.
4 The rice hispa (*Hispa armigera Gl.*).	Assessment of damage by this beetle will be made as desired by the Statistical Adviser to the Indian Council of Agricultural Research, if the pest occurs with the co-operation of the Plant Protection staff (vide the cholam ear-head bug).
5 Field rats (*Gunomys Kok G, Millardia meltada, etc.*)	Information on hand goes to show that the mole rat (*Gunomys kok*) is the most destructive species. Comparative merits of mechanical methods of digging and trapping and poison baiting showed that the former are more thorough and economical while baiting did not produce results to an appreciable degree of perfection on this species. Improvement of the technique of baiting as well as finding out a more suitable base for the poison would constitute one of the important items of research at the Agricultural Research Station, Aduthurai. The comparative damage caused by different species and their relative preference to the baits would be another line of work.

II. Cholam and millets—

1 The cholam fly (*Atherigona indica M*).	Among the various control measures like flooding, manuring, drilling, BHC and DDT as well as periodical sprays of the two chemicals, the last-mentioned method has given promising rasults at the Agricultural Research Station, Siruguppa. Further work [would lie in verifying these results and exploiting the possibilities of reducing the number of application as well as their concentrations.
2 The cholam stem-borer (*Chilo zonellus S*).	Tentative experiments with the release of Trichogramma have given indicative results. These will be pursued.
3 The cholam ear-head bug (*Calocoris angustatus L*).	Between DDT and BHC, the latter has shown a quicker and higher lethal effect. Further tests would be made on the utility of higher concentrations at lesser dosages. As desired by the Statistical Adviser to the Indian Council of Agricultural Research, a method for assessing the damage caused by this bug has been suggested in consultation with the Agricultural Meteorologist and this is being followed during the current year. The gist of the " modus " is as follows :— Counts of the progressive population in (i) healthy or mildly infested fields, (ii) severely infested and (iii) fields heavily infested but treated with BHC will be recorded. The yields of the different plots will also be assessed at harvest.

III. Sugarcane—

1 The sugarcane borers (*Argyria, Diatroea and Scirpophaga sp.*)	Studies on the influence of weather, macro climatic as well as micro-climatic factors on borer population, mortality and compensation indices studies, alternative hosts and natural enemies will be pursued at Coimbatore, as stipulated in the technical programme of the Indian Central Sugarcane Committee Scheme.

IV. Oil-seeds—	
1 The coconut caterpillar (*Nephantis serinopa M*).	Routine work on the multiplication and liberation of the parasites will be continued, keeping in mind the possibilities of improving the rearing technique. Insecticidal methods of control also will be tried if oppurtunities occur.
2 The rhinoceros beetle (*Oryctes rhinoceros L*).	Application of the synthetic chemicals in manure pits and the influence of the treatments on the grubs which breed there would be the main line of work.
3 The castor capsule borer (*Dichocrocis punctiferalis G*) and the castor mealy wing (*Trialeurodes ricini M*).	Application of DDT and BHC as dusts and sprays at periodical intervals.
4 The leaf and pod caterpillar (*Antigastra catalaunalis D*).	Application of DDT and BHC as dusts and sprays at periodical intervals.
V. Fibre crops—	
1 The cotton bollworms (*Platyedra gossypiella S and Earias fabia S*).	The possibilities of control by biological means with Trichogramma will be pursued at Coimbatore.
	At the Agricultural Research Stations, Aduthurai and Siruguppa, the efficacy of repeated applications of the synthetic chemicals in spray and dust forms will be taken up. Work on other pests of cotton like jassids, aphids, etc., will be undertaken at the Agricultural Research Station, Siruguppa.
VI. Vegetables—	
1 The potato tuber moth (*Gnorimoschema operculella Z*).	Experiments at the Agricultural Research Station, Nanjanad, on the control of this pest with the synthetic chemicals have not given conclusive results either in the field or in the godown owing to the very low incidence of the pest. The work will be continued.
	Biological control with *Microbracon gelechiae* will also be attempted.
2 Pests of sweet potatoes.	The sweet potato weevil (*Cylas formicarius Fb.*) is the major pest. A few minor pests like the stem borer (*Omphisa anastomosalis G*) the tortoise beetle (*Aspidomorpha miliaris F*) the sweet potato sphinx, etc., also make their appearance. Major attention will be concentrated towards the studies on the control of the weevil, while the others will be tackled if they appear on a pest form.
3 The onion thrips (*Thrips tabaci L*).	The field scale control of this pest will be further exploited at the Agricultural Research Station, Siruguppa.
VII. Fruits—	
1 The fluted scale (*Icerya purchasi M*).	Systematic breeding and large-scale liberation of the predator beetle (*Rodolia cardinalis Muls.*) would constitute the main item of work at Fernhill and Kodaikanal. Along with this, a survey on the incidence of the pest, alternative host plants, natural enemies, influence of weather factors on the pest and the predator will be continued.

VII. Fruits—*cont.*		
	2 The San Jose scale (*Quadraspidiotus perniciosus C*):	Control with Diesel oil emulsion constitutes the routine item of work at the Pomological Station, Coonoor. The efficacy of some of the synthetic chemicals like DDT, BHC, Parathion, etc., will be tested during the next dormant season.
	3 The woolly aphis (*Eriosoma lanigera H*).	Intensive colonization of the specific parasite (*Aphelinus mali*) is the only approved method of control which would be followed at the Pomological Station, Coonoor, until all the susceptible stocks are replaced by resistant varieties.
	4 Fruit flies on plums (*Chaetodacus Sp.*).	Observations conducted for the past two seasons at the Pomological Station, Coonoor, show that the fruits are not affected by the flies to an appreciable degree. The spraying trials with BHC and DDT in progress at present will be given up if this is confirmed. Otherwise, they will be pursued.
	5 The pomegranate borer (*Virachola isocrates F*).	In the absence of suitable gardens, near about Coimbatore, control trials with BHC and DDT will be conducted purely on an exploratory basis on the few trees available at the insectary.
	6 The fruit sucking moth (*Othreis Sp*).	Experiments initiated during the previous season, have indicated a remarkable reduction in the fruit fall caused by the moths in the case of trees sprayed with DDT. It is proposed to continue the experiments at Cuddapah with a view to minimise dosage as well as the number of applications.
	7 *Thrips on* oranges.	A report of a serious scarring of the fruits due to the thips damage recently has been recorded from Palni taluk. If the pest occurs during the ensuing flushes (July-August) the comparative merits of tobacco and the recent synthetic chemicals will be studied.
	8 The mango hopper (*Idiocerus Sp.*).	Comparative merits of DDT as spray and dust as well as a mixture of sulphur and DDT will be studied if the pest occurs.
	9 The orange borer (*Chelidonium cinctum G*).	Confirmatory tests of the results obtained with DDT and BHC against the adults of clipping the wilted twigs against the grubs will be tried during the ensuing season at Wynaad. The relative efficacy and economics of a number of fumigants like carbon-di-sulphide, chloroform, killoptera, petrol, etc., will also be tried against the grown-up borers in the trunks.
	10 Scale insects on oranges (*Lepidosaphes beckii N*).	It is proposed to try over nine variants, viz., BHC and DDT formulations, chlordane, parathion, etc., at Wynaad.
VIII. Coccids and aphids.		Insecticidal trials against coccids and aphids would constitute a general item of research.
IX. Stored products pests.		1 The effects of mixing DDT and BHC with seed material to note the reaction on the viability as well as immunity against insect damage will be studied. 2 The effects of calcium cyanide fumigation on the germinating capacity as well as the absorption of HCN will be studied with reference to seed material having a high oil content.
X. Flies (*Musca sp. an Stomoxys Sp.*).		Control of the earlier stages of cattle and domestic flies in the manure pits by the application of the synthetic chemicals will be tried.

XI. Indigenous insecticides.	This would constitute a secondary item and will be taken up as and when opportunities permit.
XII. Insecticidal trials.	Laboratory and field scale trials with new formulations of insecticides will be taken up as and when they are received.
XIII. Adverse effects of DDT and BHC.	The following would be the lines of research :— (*a*) Phytocidal action on various species of plants. (*b*) Action of the chemicals against the parasites and predators of Aphids, Coccids mites, etc. (*c*) Investigations of the factors which cause a secondary infestation of mites and aphids.
XIV. Lethal effects of BHC and DDT.	Studies on the contact and stomach action of DDT and BHC and the time taken for mortality.
XV. Bee-keeping ..	Considerable practical information has already been gathered on the maintenance of *Apis indica E.* as a profitable cottage industry but immediate attention will be concentrated on the following items to improve the performance of the bees :— 1 Swarm prevention. 2 Feeding with artificial pollen substitutes. 3 Bee enemies, if any. 4 Routine observations on the longevity, egg laying habits, pasturage etc.
XVI. Systematics ..	Preparation of the review of Thysanoptera will be continued. Systematic work on other groups like Lepidoptera, Coccidae, Acarina, etc., will be pursued. *Note.*—(1) The above programme has been drawn up with the experience gained so far and it is very likely that some of the pests mentioned above may not crop up at all, while there is every possibility of some of the unimportant forms, flaring up into prominence. Full discretion will be used in taking up the new problems according to their importance. 2 In all cases where the new synthetic chemicals are proposed to be tried, observations on the adverse effects, either phytocidal, or on the edible qualities of the produce, etc., will be made.

Appendix IV.

Statement showing the total number of sanctioned posts of officers and staff in the Office of the Government Entomologist, Agricultural College and Research Institute, Coimbatore, as on 30th June 1951.

	Number of sanctioned posts.	
	Temporary.	*Permanent.*
I. Madras Agricultural Service—		
Government Entomologist		1
Assistant Entomologists	1	3
II. Madras Agricultural Subordinate Service—		
Assistants in Entomology	2	10
Fieldmen	1	4

	Number of sanctioned posts.	
	Temporary.	Permanent.
III. Madras General Subordinate Service—		
Laboratory attenders	1	4
Insectary attender	..	1
IV. Madras Ministerial Service—		
Lower Division Clerks	2	2
V. Madras Inferior Service—		
Peons	1	6

List of permanent posts located in the districts.

	Number of sanctioned posts.	Headquarters.
I. Madras Agricultural Service—		
Assistant Entomologist	1	Fernhill.
II. Madras Agricultural Subordinate Service—		
Plant Quarantine Inspector	1	Shembaganur.
Plant Quarantine Inspector	1	Mettupalayam.

List of temporary posts located in the districts.

	Number of sanctioned posts.	Headquarters.
I. Madras Agricultural Subordinate Service—		
Assistant in Entomology	1	Kodaikanal.
Fieldmen	3	Fernhill.
Fieldmen	2	Kodaikanal.
II. Madras Ministerial Service—		
Lower Division Clerk	1	Fernhill.
III. Madras Inferior Service—		
Peons	2	Fernhill.

Orange Borer Scheme.

	Number of sanctioned posts.	Headquarters.
I. Madras Agricultural Subordinate Service—		
Assistant in Entomology	1	Kalpetta.
Fieldman	1	Do.

COIMBATORE,
8th August 1951.

S. RAMACHANDRAN,
Government Entomologist.

ADMINISTRATION REPORT OF THE GOVERNMENT MYCOLOGIST FOR THE FASLI YEAR 1360 (1950-51).

Detailed Report.

The report of the activities of the section for the year 1950-51 is presented as hereunder :—

I. Investigations on the diseases affecting food crops.
II. Investigations on the diseases of commercial crops.
III. Investigations on the diseases of fruits.
IV. Investigations on the diseases of vegetables.
V. Agro-Industries.
VI. Miscellaneous investigations.
VII. Teaching.
VIII. Grow More Food.
IX. Propaganda.
X. Plant Quarantine, Legislation and Advisory Work.
XI. Publications.

I. Investigations on the diseases affecting food crops.

1. *Diseases of rice*—(*a*) *Blast –Piricularia oryzae*—(i) *Varietal resistance trials.*—The investigations on the relative susceptibility of several promising cultures of rice were carried out in three different stations, viz., Central Farm, Coimbatore, Agricultural Research Station, Buchireddipalayam, Nellore district, and Agricultural Research Station, Aduthurai, Tanjore district. Two hundred and seventy-two cultures including those which were found to exhibit resistance in previous years were included in the trials. Besides these, new cultures comprising those of long, medium and short duration which had not been hitherto tested were also included. During the year, the incidence of the disease was very high in all the three places. The susceptible cultures suffered heavy damage and the resistant ones stood out conspicuously being very little affected by the disease. The prevalence of heavy infection enabled the correct evaluation of the reaction of the cultures. A list of cultures which exhibited high resistance as compared to the control is given in the following table :—

Table I.—*List of cultures of rice exhibiting high resistance to blast.*

Serial number and name of variety of culture.	*Duration in days.*	*Percentage of neck infection.*
(1)	(2)	(3)
1 Co. 4	180	0·0
2 Co. 26	190	0·0
3 8036	183	0·0
4 8037	180	0 0
5 3374	185	0·0
6 3839	179	0·0
7 3312	189	0·1

Serial number and name of variety of cultures.	*Duration in days.*	*Percentage of neck infection.*
(1)	(2)	(3)
8 3892	166	0·1
9 8212	169	0·1
10 2744	189	0·2
11 Co. 25	180	0·4
12 3808	183	0·5
13 3397	189	0·8
14 3381	183	0·9
15 3883	190	0·9
16 8348	182	1·0
17 8343	189	1·1
18 1834	186	1·1
19 3273	190	1 2
20 2366	183	1·8
21 2465	185	1·9
22 2364	190	2·1
23 3185	185	2·2
24 3941	186	2·3
25 1952	180	2·3
26 1914	186	2·6
27 1201	140	5·9
28 4005	176	6·0
29 3820	180	6·6
Adt. 10 (control)	165	81·1

Among the two hundred cultures from the collection of world varieties with the Paddy Specialist, eighteen were found to be uninfected even after heavy bombardment with concentrated spore-suspension of the fungus. These were selected for further trials and are listed below :—

TABLE II.—*List of cultures selected from world varieties for intensive trial in the fields.*

Type number.	*Name.*	*Origin.*	*Duration in days.*
(1)	(2)	(3)	(4)
46	1 Bankur	Central Provinces.	97
51	2 Sakkalati chama chatia	Mysore extracted.	113
88	3 Special plant 790/N/c	Do.	92
89	4 Special plant 744/W/2	Do.	119
111	5 G. straw	Do.	80
115	6 G. T. Ripe black	Do.	94
323	7 Ngacheik	Burmah	121
379	8 Saloo	United States of America.	128
381	9 Honduras	Do.	107
458	10 Pisutong	Ganjam	110
477	11 Mulla	Coorg	120
568	12 Americano	Italy	56
700	13 Domerara Creole	Br. Guiana	100
704	14 Ramcjara	Do.	100
827	15 C. 32-1	Burmah	103
859	16 Manse Marijango (M)	West Africa.	98
882	17 46 Palman	Punjab	98
897	18 Agyfidangsican	Russia	75

With a view to assessing the actual loss caused by the disease in a susceptible variety, detailed observations were recorded

in an area of two cents in a heavily infected field. It was found that there was a loss of 70 per cent in grain yield and 40 per cent in straw yield.

(ii) *Effect of application of graded doses of N, K_2O and P_2O_5 on the incidence of disease.*—Field experiments were carried out in Coimbatore on the same lines as in the previous years. The object was to find out whether the effect of increasing levels of N on the incidence of blast could be counteracted by balancing the the nitrogenous manures with varying levels of potassic and phosphatic manures. N was supplied in the form of ammonium sulphate at the rate of one cwt., two cwt., or three cwt. per acre. K was applied in the form of potassium sulphate at the rate of 1, 2 or 3 cwt. per acre and phosphorus was applied in the form of superphosphate at 1, 2 or 3 cwt. per acre. Adt. 10 was planted in all the treatments. The results are given below :—

TABLE III.—*Effect of varying levels of nitrogen, potash and phosphorus on the incidence of blast and grain yield.*

Serial number and treatment.	*Incidence of leaf infection (category values assigned.)*	*Percentage of neck infection.*	*Grain yield in ounces.*
(1)	(2)	(3)	(4)
1 N — 1	249	51·8	14·1
2 N — 2	475	51·8	13·9
3 N — 3	720	71·3	13·3
4 K — 1	249	45·0	15·9
5 K — 2	306	48·0	11·7
6 K — 3	252	50 9	13·9
7 P — 1	275	46·9	13·4
8 P — 2	271	45·3	15·8
9 P — 3	291	54·7	11·9
10 N — 3 + K — 1	631	70·5	12·3
11 N — 3 + K — 2	740	68·8	13·1
12 N — 3 + K — 3	679	72·0	12·3
13 N — 3 + P — 1	717	72·4	13·9
14 N — 3 + P — 2	705	61·8	18·2
15 N — 3 + P — 3	727	61·4	15·2
16 N — 3 + K — 1 + P — 1	745	64·0	13·2
17 N — 3 + K — 2 + P — 2	735	66·6	12·5
18 N — 3 + K — 3 + P — 3	765	67·5	15·4
19 Control	222	48·8	14·9

It will be seen that under conditions of the experiment K or P do not exert any counteracting influence and that N alone has decided effect.

(iii) *Determination of factors for disease resistance.*—It has been reported that in rice, resistance to blast is correlated with the extent of silicification of the epidermal cells. In order to correlate the distribution of silica and the relative resistance of the cultures, twenty cultures of varying grades of susceptibility were utilized for the estimation of silica distribution. It was found that resistance to blast was definitely correlated with the distribution of silica per unit area of the epidermis. With the increase in the dosage of

nitrogenous manures it was observed that there is a tendency for reduction in the degree of silicification in both resistant and susceptible cultures.

(*b*) *Foot-r t—Fusarium moniliforme*—(i) *Varietal resistance.*—Twenty-three cultures of rice made up of those evolved at Pattambi and Aduthurai and some blast resistant cultures were utilized to evaluate the degree of resistance to this disease. Co. 10 was used as the control. Heavy incidence of disease was recorded and the results are given under.

TABLE IV.—*Foot rot of rice—Varietal resistance trials—Incidence of disease in the varieties.*

	Serial number and name of variety or culture.	*Percentage of mortality.*		*Serial number and name of variety or culture.*	*Percentage of mortality.*
1	Adt. 13	91 8	13	Adt. 1	67·6
2	Co. 10	88·8	14	Ptb. 14	65·1
3	Co. 11	88·8	15	Adt. 21	64·4
4	Adt. 17	80·6	16	Ptb. 15	63·5
5	Adt. 2	79·5	17	Ptb. 14	58·1
6	Adt. 22	78·4	18	8036	54·1
7	Adt. 15	78·1	19	GEB. 24	41·9
8	Ptb. 13	76·8	20	Ptb. 12	40·1
9	Adt. 3	75·9	21	Ptb. 1	31·2
10	Ptb. 16	74·5	22	Adt. 11	24·9
11	2554	68·5	23	Ptb. 7	4·5
12	3912	67·8			

Ptb. 7 was found to be highly resistant while even GEB. 24 exhibited nearly 42 per cent infection.

(ii) *Fungicidal trials.*—In continuation of the work carried out in previous years, seed treatment with eleven fungicides besides Agrosan GN. and Ceresan were carried out for evaluation of their comparative efficacy in controlling foot rot. All the fungicides were found to be quite effective in controlling the disease. The results are recorded below.

TABLE V.—*Foot rot of rice—Fungicidal trials—Incidence of disease.*

	Serial number and name of fungicides.	*Rate.*	*Percentage of mortality.*
	(1)	(2)	(3)
1	Control	....	48·5
2	Perenox	One part of the seed dressing for 448 parts of grain by weight.	6·5
3	Leytosan	Do. ..	4·3
4	Uspulun	Do. ..	3·5
5	Phygon	Do. ..	3·2
6	Aagrano	Do. ..	3·0
7	Atiman	Do. ..	2·9
8	Agrosan 4	Do. ..	2·7
9	Margamma	Do. ..	2·2
10	Harvesan	Do. ..	2·2
11	Ceresan (Tillantin R) ..	Do. ..	1·3
12	Ceresan (Japan)	Do. ..	1·2
13	Certosan	Do. ..	1·0
14	Agrosan GN	Do. ..	0·8

2. *Cereal rusts*—(i) *Wheat rusts.*—(*Puccinia graminis*) black rust, (*Puccinia triticina*) brown rust, (*Puccinia glumarum*) yellow rust.

On the Nilgiris, brown rust was widespread on "local samba" (*Triticum dicoccum* ?) and *T. vulgare*. The incidence of infection was 100 per cent in the later stages of the crop. At Coimbatore, brown rust was noticed on Khapli and *T. vulgare*. Black rust was not observed on "local samba" (*T. dicoccum* ?) on the Nilgiris but it was present on *T. vulgare*. At Coimbatore, black rust was found to be severe on N.P. 165 in December-January. But on the Nilgiris, black rust was found to be common only in February-March. Yellow rust was noticed mostly on the barley crop in June as well as in January.

Five rust resistant Australian varieties of wheat had been introduced for trials on the Nilgiris during 1949–50. Four of these, viz., Gebo, Kendee, Charter and Celebration were found to be satisfactory and were further multiplied during this year. These were highly resistant to both black and brown rusts and gave a much higher yield than the local variety. The performances were so much appreciated by the ryots that they were very anxious to cultivate these varieties in preference to the local variety. During this summer, they have been grown in five different places on the hills to note their suitability to these tracts. The crop has grown well and is nearing harvest Stray sori of brown rust were noticed on Celebration in one locality where the local wheat had over 60 per cent infection. These were not however found to be equally suitable for cultivation at Coimbatore. The variety Celebration exhibited medium infection by black rust at Coimbatore. But Charter matured very early and had no rust incidence. The variety NP 165 which is alleged to be very resistant to black rust was cultivated at Coimbatore and found to be highly susceptible under local conditions. The local strain of black rust was inoculated on seedlings of NP 165 and fresh infections became evident in the course of ten to twelve days. By repeated infection of successive crops of seedlings of this variety, the rust has been maintained throughout the summer at Coimbatore. This indicates that under sheltered conditions this rust can over-summer at the temperature prevalent in this area, if suitable host plants are available. It becomes evident that foci of infection of this rust need not be located on the hills but may exist even in the plains or on the foot hills where favourable conditions exist.

(ii) *Sorghum rust—Puccinia purpurea.*—The various species and cultures of *Sorghum* grown at the Millets Breeding Station were periodically examined to note the relative incidence of rust on these at different times of the year. Thirty-four cultures belonging to nine species of *Sorghum* were found to exhibit either freedom from rust or less than four per cent crop infection. The seeds of these were selected for further field trials during the

coming season. Seedlings were raised in pots and subjected to artificial inoculation but they were not infected. Germinating teliospores were inoculated on plants belonging to Convolvulaceæ, Compositæ and Euphorbiaceæ to find out whether any of them served as alternate hosts for this rust. There was no infection in any of these.

(iii) *Cumbu rust—Puccinia penniseti.*—The cultures of this crop grown at the Millets Breeding Station were periodically examined for assessing their relative resistance to rust. All the cultures were found to be highly susceptible exhibiting 100 per cent crop infection and 25 to 80 per cent plant infection. The culture 814/3 which had a very low incidence of rust during the previous season was found to have 40 to 50 per cent infection during this year. Four other species of *Pennisetum* were artificially inoculated to find out whether these serve as collateral hosts but no infection was evident. Hybrids between *P. typhoides* and *P. purpureum* exhibited a high degree of resistance.

(iv) *Tenai rust—Uromyces setariae-italicae.*—Periodical observations were made on the cultures of *Setaria*, grown at the Millets Breeding Station. All the cultures including 4054 were found to be heavily rusted. The intensity of infection is recorded below.

TABLE VI.—*Incidence of rust on the various cultures of Tenai grownat Millets Breeding Station.*

Name or number of culture.	*Crop infection expressed in percentage.*	*Plant infection in percentage.* (1–12–1950) *1st week of December* 1950.	(28–12–1950) *Last week of December* 1950.	*Percentage of infected leaves per plant.*
(1)	(2)	(3)	(4)	(5)
S.I. 3560	100	51·75	100·0	100·0
S.I. 3756	50	7·6	32·5	36·25
S.I. 5006	100	43·25	80·0	100·0
S.I. 5007	100	36 25	60·5	100·0
S.I. 5008	100	32·25	100·0	100·0
S.I. 5009	100	50·0	100·0	100·0
S.I. 5010	90	34·75	71·0	71·5
S.I. 5011	100	23·5	31·0	60·0
S.I. 5012	94	48·0	100·0	100·0
S.I. 5013	100	29·75	100·0	100·0
S.I. 5014	97	49·5	100·0	100·0
S.I. 5015	100	31·5	55·0	100·0
S.I. 5016	100	40·75	80·0	100.0
S.I. 5017	100	15·5	27·5	40·0
S.I. 5018	100	14·0	25·0	50·0
S.I. 5019	100	41·5	75·5	100·0
S.I 5020	100	56·0	70·5	80·0
S.I. 5021	90	21·5	31·0	50·0
S.I. 5022	98	6·4	48 0	75·0
S.I. 5023	100	48·4	59·0	100 0
Co. 1	100	24·4	100·0	100 0

The geographic forms of *S. italica*, viz., Chinese, German, Siberian and American obtained from the Cytogeneticist, Coimbatore, were grown in the pot culture house and subjected to artificial infection. All of them were readily infected. *S. verticillata* and *S. glauca* were not infected. The infection on *S. italica* is favoured by high humidity and outbreaks of rust in the field are found only when rains are received. Fifty cultures of *S. italica* received from the Superintendent, Agricultural Research Station, Hagari, are under test to note their relative resistance to rust.

3. *Sorghum long smut—Tolyposporium ehrenbergii*.—This smut is becoming more serious in Madurai, Ramanathapuram and Tirunelveli districts. The variety known as "Vellai" locally is highly susceptible while "Irungu" is not readily affected. The crops sown in (Thai pattam) January and March-April (Chittirai pattam) are infected. It has been established that the infection is air-borne and through the flower. Hence, seed treatment is of no avail. The spores have been found to retain their viability for two years. Trials at Coimbatore with different cultures of *Sorghum* have shown that Co. 1, Co. 5, Co. 6, Co. 9, Co. 10, Co. 11, AS. 7571 and AS. 7589 were susceptible. Further trials are in progress. This fungus does not pass on to *Pennisetum typhoides* or *P. purpureum*.

4. *Potato—Early blight—Alternaria solani*.—Early blight of potato is common on the Nilgiris. Protection of the crop by spraying with one per cent Bordeaux mixture has given satisfactory results. The plants remain green for ten to twelve days longer than the controls and a higher yield of tubers is obtained. The trials in ryots' lands conducted during the year have shown an increase of 10 to 15 per cent of tubers by weight, from the sprayed plots. The comparative efficacy of Bordeaux mixture, Dithane 14 and Dithane Z. 78 was under investigation. The experiments were carried out at the Agricultural Research Station, Nanjanad, in replicated plots. The incidence of early blight was found to be very low in the sprayed plots as compared with the controls. The sprayed plants remained green for ten days more than the controls. No difference could be detected between the three treatments in regard to the control of early blight. The crop is not yet harvested and hence differences in yield have not yet been recorded.

II. Investigations on the diseases of Commercial Crops.

(i) *Cotton—Black arm. Xanthommonas malvacearum*.—This disease has been under investigation for over a number of years. The relative resistance of the promising cultures of cotton is being tested in collaboration with the Cotton Specialist. During the year, the incidence of black arm in the experimental plots was

widespread. The culture 458–1 which had exhibited high resistance to black arm during the previous years was found to be heavily infected, the incidence being on a par with the control. But a new culture 2196 exhibited freedom from infection in most of the progeny. These have been selected for further trials. A search for collateral hosts of this bacterium revealed that leaf spot is caused by the pathogen on *Hibiscus vitifolius*, a common weed in the black cotton soil. The incidence of black arm has been found to extend to most of the districts where cambodia cotton is cultivated.

(ii) *Cardamom research*.—A scheme for scientific aid to the cardamom industry in South India, partially financed by the Indian Council of Agricultural Research, is in operation at Singampatti. The control of this scheme which was vested with the Government Mycologist was transferred to the Oil Seeds Specialist with effect from February 1951.

(iii) *Pepper research*.—A scheme for the improvement of this crop was commenced in December 1949 and was under the control of the Government Mycologist till January 1951. This has been now transferred to the control of the Oil Seeds Specialist.

(iv) *Ginger-Rhizome rot—Pythium spp.* and *Sclerotium rolfsii*.—Rhizome rot of ginger is prevalent on the West Coast. Previous experiments have shown that rhizome treatment with 0·1 per cent solution of mercuric chloride was effective in preventing storage rot. But this treatment had no influence on the incidence of wilt in the field. In order to find out whether the application of fungicides to the soil before planting the rhizomes will control the incidence of the wilt, experiments were laid out at the Agricultural Research Station, Pattambi, in collaboration with the Paddy Specialist. Six fungicides were under trial. It was found that Bordeaux mixture and mercuric chloride depressed the germination of rhizomes while the highest number of shoots was found in the plots treated with cheshunt compound and colloidal copper. The yield of healthy rhizomes from the plots treated by the last two fungicides was far above the others. The experiments have been repeated during the current season. Based on these results, a large scale trial has been made with chetsunt compund in a ryot's field near Kozhikode.

Treatment of the seed rhizomes before storage was carried out with a number of fungicides. It was found that immersion in 0·1 per cent mercuric chloride solution or 0·25 per cent Ceresan (wettable) gave the highest outturn of healthy rhizomes. Cultivation of ginger under shade gave a higher yield than from plots which were not shaded.

Sclerotium rolfsii was found to cause extensive rotting of ginger in the neighbourhood of Agricultural Research Station, Pattambi. The fungus was isolated and found to be pathogenic to the rhizomes

and the shoots causing rotting of rhizomes and wilting of shoots respectively. The soil and rhizome treatments were equally effective in controlling the disease by this fungus also.

III. Investigations on the diseases of fruits.

(i) *Orange, Citrus reticulata* Decline.—The decline of oranges is prevalent in Wynaad. A scheme was in operation for the investigation of this phenomenon but it was terminated with effect from 31st May 1951 owing to the interference in the experimental plots by the owners in whose orchards the experiments were laid out. The survey of the gardens which was commenced during the previous year was completed involving one hundred and sixteen estates with a total extent of 3,724 acres. It was found that excepting in very few gardens application of manure to even bearing trees was not in vogue. The soil round the trees was dug twice in the year to depths up to 9 inches resulting in wounding of the roots. The situation of the gardens was not always satisfactory and all types of available land appear to have been utilized. The decline was more in evidence in gardens which were south or west facing and where no manuring had been practised.

Three fungi, viz., *Fusarium solani*, *Rhizoctonia bataticola* and *Diplodia* sp. had been isolated from the dying roots of trees affected by decline. These were used for carrying out artificial infection on healthy plants growing in pots. Very few of the inoculated plants exhibited drying. Re-isolations from the roots of these plants consisted of fungi different from those, used for inoculation. This indicated that the death of the plants must be due to other causes and not due to the pathogenicity of the fungi used for inoculation.

Complete manures made up of 75 lb. of cattle manure, 10 lb. of groundnut cake, 1½ lb. of potash, 20 lb. of wood ash and 1 lb. of superphosphate were found to improve the condition of the trees resulting in good flush and green foliage. The controls exhibited mottling and yellowing of leaves. The benefits were so apparent that some of the progressive orchardists adopted this for all the trees in the garden. Application of 20 lb. of lime to the soil per tree was also found to be beneficial and this practice was also carried out throughout the orchard by a number of growers. Drenching the soil round the trees with Bordeaux mixture or application of a mixture of copper sulphate and lime in the proportion of 1 : 2 using 1½ lb. per tree did not lead to any improvement.

In Wynaad, rainfall is either absent or very meagre during the months of December to May. During this period the trees are exposed to droughty condition with no possibilities of irrigation. It was however, found that if the soil round the trees was covered with a thick layer of mulch during this period, the moisture content of the soil was conserved. The effect could be seen in the green and flushed appearance of the trees receiving this treatment

Some of the garden owners are adopting this method in their gardens. Digging the soil round the trees was found to cause adverse effects on the growth of the trees. Casualties were noticed among the trees receiving this treatment. *Pueraria javanica and Centrosema pubescens* were tried as cover crops but no tangible effect could be seen during the short period they were on the ground.

(ii) *Wilt of melons—Pythium aphanidermatum.*—During the year the cultivation of this crop was tried in the college orchards. A number of young plants exhibited symptoms of wilt, preceded by root rot and splitting of the lower portions of the stem. The fungus *P. aphanidermatum* was isolated from the infected roots. An experiment was laid out to find out the effect of drenching the soil with cheshunt compound on the control of this disease. No further casualties were observed in the treated plots.

IV. Investigations on the diseases of vegetables.

(i) *Wilt of brinjal—Fusarium Sp.*—This fungus had been isolated from the roots of wilting brinjal plants. Inoculation experiments proved the pathogenicity of the isolate on brinjal. It was found that the fungus is not able to grow in soils with a high moisture content whereas it develops well when the moisture content is about 40 per cent or below.

(ii) *Root rot of brinjal, cluster beans and bengal—Rhizoctonia bataticola.*—The isolate from each host was used for inoculation on all the three hosts. It was found that they readily parasitised all the three hosts. The development of this fungus in sterilized and unsterilized soils at different levels of moisture content was determined. It was found that in unsterilized soil the rate of growth of the fungus fell when the moisture content was above 30 per cent and in sterilized soil at 45 per cent. The rate of growth was higher in sterilized soil as compared to that in unsterilized soil.

Two species of *Aspergillus*, viz., *A. niger* and *A. nidulans* were isolated from the soil and their effect on the growth of *Rhizoctonia* determined. It was found that when grown together in culture dishes, the *Aspergilli* kept down *Rhizoctonia*. But extracts or filtrates of media in which the *Aspergilli* had grown had no adverse effect on *Rhizoctonia*. This shows that *Rhizoctonia* was kept down by mere competition and not due to any toxic or antibiotic effect of the *Aspergilli*.

(iii) *Fruit rot of chillies—Alternaria* sp.—A new type of fruit rot caused by *Alternaria* was prevalent in Guntur and Madurai districts. The fungus was isolated and studied in culture. Inoculation experiments proved its pathogenicity on the fruits of chillies, tomato and brinjal. The fungus did not infect leaves of *Capsicum*. A culture of *Alternaria capsici-annuii* was obtained from the Indian Agricultural Research Institute, for purposes of comparative study. The studies are in progress.

V. Agro-Industries.

(i) *Ergot of rye—Claviceps purpurea.*—The production of this drug was continued on the Nilgiris. An area of 73 acres was sown to rye during the year. The total production of ergot amounted to 403 lb. The fall in yield was due to the absence of rainy weather during the critical period of flower infection.

The Government have sanctioned the continuance of ergot production on a permanent basis from the beginning of April 1951. A separate farm for production of ergot is to be started. Search for a suitable location of the farm in the neighbourhood of Ootacamund was made and a site near Ree's corner belonging tothe Forest Department has been selected and submitted for approval. Owing to dearth of sufficient seed material an indent was placed with the Government of India to obtain two tons of rye seed from Italy. The consignment was received by the middle of April 1951. During the 1951–52 season, fifty-two acres have been sown to rye. Of this area, the Italian seed has been sown in 24 acres and the original black winter rye in the rest of the area. The latter came into flower in the early sown plots by the middle of June and spray inoculation of the flowers is in progress. But the growth of the Italian rye has been disappointing. It is stunted and bushy and flowering has not yet commenced.

(ii) *Food yeast—Torulopsis utilis.*—A pilot plant which had been erected in previous years was in operation for a period of 149 days during the year. Some of the equipment had deteriorated and was in need of replacement. Orders were received instructing the closure of the plant. Since January 1951 the plant was not in operation. Nine hundred and eighteen pounds of dry yeast were prepared and sold to hospitals and other indentors.

Frothing in the fermentation tank was always a source of inconvenience during the period of aeration. It was found that by adding small quantities of groundnut-oil on the surface of the wort frothing could be minimised. The oil however did not adversely affect the produce.

VI. Miscellaneous investigations.

(i) *Cinchona diseases—Stem canker root rot and collar rot—Phytophthora Sp.*—In the previous year *Phytophthora cinnamomi* had been isolated from the infected tissues and found to be pathogenic. During this year another species, viz., *P. palmivora* was also isolated from some of the diseased material.

In order to control the spread of the disease in the plantation, spraying experiments were conducted on the Anamalais with Bordeaux mixture, and Perenox. The stem was washed with these fungicides before the monsoon. Counts of disease incidence were taken before spraying and again in September after the

south-west monsoon. It was found that the disease had spread to a larger number of trees in the control plots, indicating thereby the benefits of spraying.

(ii) *Ergot on Pennisetum.*—During the year the incidence of *Claviceps* infection was noticed on a hybrid between *P. purpureum* and *P. typhoides*, at the Millets Breeding Station. The fungus was found to resemble the one occurring on *Cenchrus ciliaris*, *C. setigerus* and *P. hohenackeri*. Inoculation experiments carried out with conidia on *P. purpureum*, *P. polystachyon*, *P. typhoides* and a number of hybrids between *P. typhoides* and *P. purpureum* gave positive infection in the course of six to seven days. The progress of infection on *P. typhoides*, was closely followed. The sclerotia were analysed and the alkaloid content was found to be negligible. The conidia remained viable for over seven months. High humidity was necessary for positive infection.

(iii) *Ergot on Brachiaria ramosa.*—This fungus was common on this grass in several villages of the Malnad area of South Kanara. The sclerotia on analysis exhibited a high alkaloid content. Guinea pigs fed with a mixture containing the sclerotia, died, indicating the poisonous nature of the fungus.

(iv) *Bacterial disease of sugarcane.*—A new type of bacterial disease was observed on one of the cultures of sugarcane, growing at the Sugarcane Breeding Institute, Coimbatore. Numerous minute red spots developed on the leaves. A bacterium was isolated from the infected tissue. It was found to be pathogenic to sugarcane. It is rod shaped, gram negative, non-flagellate and capable of hydrolising starch.

(v) *Bacterial disease of cumbu.*—A dark brown leaf spot was prevalent on many of the cultures of cumbu at Coimbatore. A bacterium was isolated from the diseased spots and was found to be pathogenic producing dark brown spots in the course of seven days. Further studies are in progress.

(vi) *Edible mushroom—Volvaria diplasia.*—The cultivation of this mushroom was continued. There was a demand for spawn of this mushroom from different parts of the union and one hundred and nineteen bottles were sold.

In the pine forests of Kodaikanal an edible mushroom is found naturally growing in the soil. This was identified to be a species of *Russula*.

(vii) *Systematic mycology.*—A number of fresh collections of fungi were examined during the year. Many of them were identified and added to the herbarium. The collections included several new species of Uredineae and other groups.

(viii) *Agri tree killer.*—There was a persistent demand for this preparation from the Archæological Department and ryots. The

use of this material for the eradication of *Morinda* from cultivated fields is becoming popular among the ryots. About ninety gallons of this preparation were sold during the year.

VII. Teaching.

Forty-six lectures were delivered to the students of the final year B.Sc. (Ag.) class in Mycology and Plant Pathology. Fifty-four practical classes were conducted. Lectures and practical demonstration of symptoms and control measures of diseases affecting horticultural crops were given to the students of the Diploma course in Horticulture. Specimens of fungi and cultures of fungi were distributed to different educational institutions.

VIII. Grow More Food.

The Plant Protection staff attended to the calls for help from ryots in controlling the diseases of crops throughout the State. The two strains of rice Co. 25 and Co. 26 which are resistant to blast were popularized and their cultivation extended to about a lakh of acres in Tanjore, Tiruchirappalli and neighbouring districts. Seed dressing of rice with Agrosan GN. was carried out in several districts for the control of foot-rot and helminthosporiose. An area of 82,000 acres was sown to treated seed. Sulphur was distributed for the treatment of sorghum and Setaria seeds to control the respective smuts. An area of 285,000 acres of sorghum was sown with disinfected seeds. Demonstrations of nursery spraying were conducted in rice and ragi nurseries to combat blast disease. Bordeaux mixture was sprayed in a number of localities on the Nilgiris on potato for the control of early blight with satisfactory results. Oranges all over the State were sprayed with zinc sulphate lime mixture for the control of mottle leaf. On the Nilgiris and Wynaad large scale spraying of oranges with Bordeaux mixture was adopted for the control of leaf fall and fruit rot.

IX. Propaganda.

This section contributed a number of articles for publication in the Departmental journals on the methods of controlling diseases of crops. Descriptive charts and typical specimens of crop diseases and methods of their control were exhibited in several important shows and exhibitions. A number of new posters have been prepared for propaganda purposes.

X. Plant Quarantine, Legislation and Advisory Work.

Numerous consignments of plant material, seeds and tamarind intended for export were examined and necessary phytosanitary certificates issued.

The Madras Agricultural Pests and Diseases Act was in operation in this State in respect of the following diseases :—

(1) Bud rot of palms (palmyra and coconut)—East and West Godavari, Krishna and three taluks of Malabar.

(2) Sugarcane smut—Hospet taluk, Bellary district.

(3) Cardamom mosaic—Nelliampathys—Palghat.

(4) Wheat rust -Banning of the summer crop of wheat throughout the State.

(5) Spike diseases of sandal—Salem district.

One hundred and seventy-seven specimens were received, examined and reported upon during the year.

XI. Publications.

The following papers were sent up for publication during the year under report :—

(1) Food Yeast	Sri D. Marudarajan, Madras Agricultural Journal, Vol. 38, pages 255–258.
(2) Importance of Disease Control in maximization of crop production.	Sri D. Marudarajan, Madras Agricultural Journal, Vol. 38, pages 56–60.
(3) Fungicides and Weedicides ..	Sri D. Marudarajan. Paper submitted for Indian Science Congress.
(4) Additions to Fungi of Madras X, XI and XII.	Sri T. S. Ramakrishnan, Proc. Ind. Acad. Sci. (in the press).
(5) A new rust on *Antidesma* ..	Sri T. S. Ramakrishnan and Sri N. V. Sundaram, Trans. Brit. Mycol. Soc. (in the press).
(6) Collar rot, Root rot and Stem Canker of Cinchona on the Anamalais.	Sri T. S. Ramakrishnan, Paper submitted for Scientific Conference.
(7) Studies on varietal resistance of rice to the 'Blast' disease (*Piricularia oryzæ*).	Sri C. S. Krishnaswamy, Sri C. V. Govindaswamy, Sri N. R. Adyantayya and Sri G. Rangaswamy. Paper submitted for Scientific Conference.
(8) Ginger—*Sclerotium rolfsii* ..	Sri N. V. Sundaram, Madras Agricultural Journal, Vol. 38, pages 225–226.
(9) Media for mass cultures of the ergot fungus.	Sri M. Kandaswamy. Paper submitted for Scientific Conference.
(10) Estimation of Silica in relation to resistance to blast disease in rice.	Sri N. R. Adyantayya and Sri G. Rangaswamy. Paper submitted for Scientific Conference.
(11) Fruit rot of chillies caused by *Alternaria*.	Sri C. L. Subramaniam. Paper submitted for Scientific Conference.
(12) Long Smut of Sorghum	Sri G. Siddalinga Reddy. Paper submitted for Scientific Conference.

Acknowledgment.

I have to record my appreciation of the loyal co-operation and sense of duty of the members of the staff in carrying out the various activities of the section. I am thankful to the heads of sections at the Institute and various district officers and subordinates who have helped in various ways in the conduct of several investigations.

Coimbatore,
31*st July* 1951.

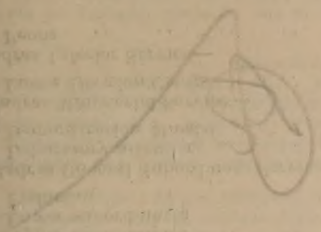
T. S. RAMAKRISHNAN,
Government Mycologist.

Annual programme of work for the year 1951–52.

1 Studies of Pythiaceous fungi.	Further studies on the isolates of *Phytophthora* and *Pythium* isolated from different crops will be made. The persistence of *Pythium aphanidermatum* in soils under different moisture and temperature conditions will be investigated.
2 Rice diseases —	
(*a*) Blast—*Piricularia oryzæ*.	In collaboration with the Paddy Specialist the relative resistence of the promising cultures of long, medium and short duration will be tested at Coimbatore, Aduthurai and Buchireddipalayam. The influence of different dosages of manures and different levels of soil moisture on the incidence of blast will be further investigated. The correlation between the number and distribution of silicated cells and the stomata in the epidermis of resistant and susceptible cultures will be worked out.
(*b*) Foot rot—*Fusarium moniliforme*.	The persistence of the fungus in the soil under different conditions will be investigated. The efficacy of new fungicides on the control of this disease will be tested. The occurrence of races of the pathogen will be studied.
(*c*) Stem rot—*Sclerotium oryzæ*.	The conditions favouring successful infection will be studied. Relative resistance of different varieties will be observed at Aduthurai as the disease is common in Tanjore district.
3 Ragi.—Blast—*Piricularia Sp*.	In collaboration with the Millets Specialist the testing of relative resistance of different cultures will be carried out.
4 Cereal rusts—	
(*a*) Wheat rusts—Black, brown and yellow rusts.	The multiplication of the Australian varieties of rust resistant wheat will be pushed through. Their performance in yield and resistance to rust will be observed. The search for collateral hosts of these if any will be continued. Infection studies will be made at Coimbatore throughout the year with black rust to find out if the fungus can survive the summer conditions at Coimbatore
(*b*) Sorghum rust—*Puccinia purpurae*.	The resistance of selected cultures will be further tested. The pathogenicity of this rust on other grasses and dicots will be investigated with a view to find out the collateral and alternate hosts respectively.
(*c*) Cumbu rust—*Puccinia penniseti*.	Infection studies will be made with this rust on cumbu and the progeny of the crosses of this host with *P. purpureum* to follow the inheritance of resistance to rust. The performance of the cultures which exhibited lower incidence will be further tested.
(*d*) Setaria—*Uromyces setariat italicae*.	Collections of this rust from Hagari and Coimbatore will be compared for their relative pathogenicity on selected strains of the millet. The reaction of the different species of *Setaria* to these collections will also be studied. The occurrence of collateral hosts if any will be observed.
Cotton—Black arm—*Xanthomonas malvacearum*.	The performance of the selected cultures of cotton will be further tested in collaboration with the Cotton Specialist. The role of other malvaceous plants as hosts for this bacterium will be investigated.

Annual programme of work for the year 1951–52—*cont.*

6 Vegetable diseases— Wilt and root rot of tomato, brinjal, etc.	Studies of the *Fusaria* and *Pythium* isolated from the affected plants in relation to their pathogenicity persistence in the soil under different conditions of moisture, content, manures and the presence of other competing saprophytic fungi will be carried out. Effect of soil application of cheshunt compound and colloidal copper on the control of the disease will be tested.
7 Ginger diseases— (*a*) Rhizome rot.	The effect of soil treatment with different fungicides, different manures and shade on the field incidence of the disease and yield of rhizomes will be investigated in collaboration with the Paddy Specialist at the Agricultural Research Station, Pattambi.
(*b*) Sclerotial disease.	The pathogenicity of the fungus on various varieties of ginger will be tested. The effect of soil treatment on the control of this disease in the field will be studied. The loss caused by this fungus by causing storage rot will be assessed.
8 Ergot fungi— (*a*) Ergot of rye.	Large scale production of ergot of rye on the Nilgiris will be continued, New stock of Italian rye has been received and this will be utilized for sowing. Its influence on yield of ergot will be observed. The improvement of the quality of ergot by selection of *sclerotia* and treating them with *colchicine*, etc., will be tried.
(*b*) Ergot of cumbu and allied grasses.	Infection of the ears of the progeny of a cross between cumbu and *Pennisetum purpureum* has been noticed. This is akin to what has been observed on certain grasses like *Cenchrus ciliaris*. The host range of this ergot and the alkaloid content of the *sclerotia* will be determined.

Appendix.

Serial number and name of service and post.	*Number of sanctioned posts.*	
	Permanent.	*Temporary.*
I. Madras Agricultural Service—		
1 Government Mycologist	1	..
2 Gazetted Assistant in Mycology	..	1
3 Assistant Mycologist (Paddy Scheme)	..	1
4 Assistant Mycologist (Ergot Scheme)	1	..
II. Madras Agricultural Subordinate Service—		
1 Upper subordinates	10	2
2 Lower subordinates	..	..
3 Fieldman	6	
III. Madras General Subordinate Service—		
1 Laboratory attenders	4	1
2 Demonstration Maistri	2	..
IV. Madras Ministerial Service—		
Lower Division Clerks	3	..
V. Madras Inferior Service—		
Peons	6	1